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ABSTRACT

MATHCO is a motivating series of audiovisual and print materials designed to overcome the negative effects of sex bias and stereotyping on the attitudes, interests, and aspirations of girls toward mathematics and mathematics-related careers. The materials teach mathematics skills, demonstrate relationships between mathematics and other subjects, and provide exposure to mathematics-related careers. They are useful for boys as well as girls at the pre- and early-adolescent stage; they are both multiethnic and nonsexist in text and illustrations. Module 2 focuses on patterns, sequences, and equations in language and fine arts as well as in mathematics. The audiovisual script is included, followed by suggested activities and activity work. (MNS)

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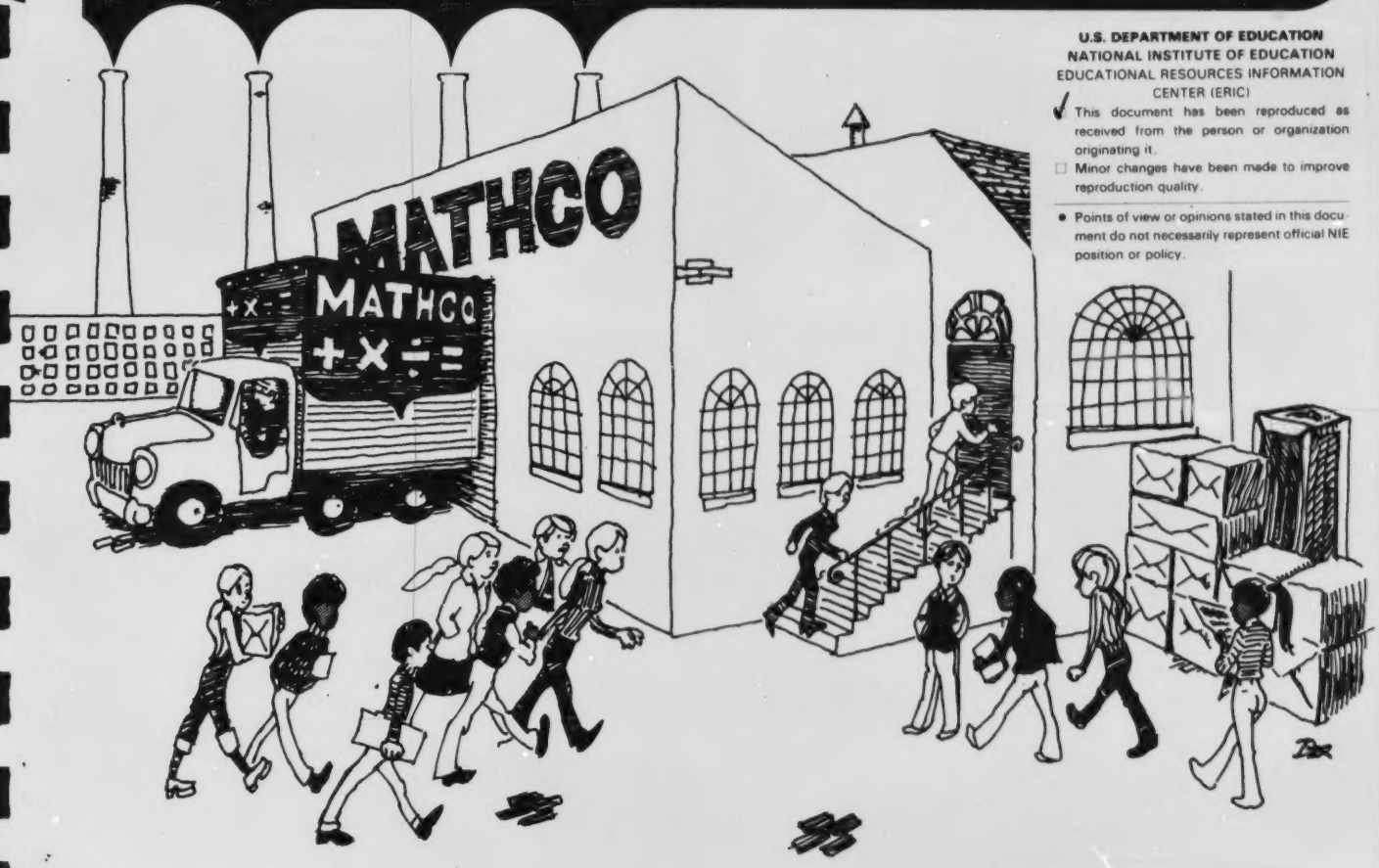

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U.S. Department of Education

MATHCO TEACHER'S GUIDE

MODULE 2

Patterns, Sequences, and Equations (Math and Language/Fine Arts)

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WOMEN'S EDUCATIONAL EQUITY ACT PROGRAM
U.S. DEPARTMENT OF EDUCATION
T. H. Bell, Secretary

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STATEMENT OF ENDORSEMENT

The National Review Board has carefully examined and heartily endorses MATHCO as a high-quality and motivating series of audiovisual and print materials designed to overcome the negative effects of sex bias and stereotyping on the attitudes, interests, and aspirations of girls toward mathematics and math-related careers.

These materials have been designed to teach math skills, demonstrate interrelationships between math and other subjects, and provide exposure to a wide variety of math-related careers. These informational and skill-building activities are valuable for boys as well as girls and are both multiethnic and nonsexist in text and illustrations.

We believe that the use of these materials with pre- and early-adolescent students can help to alleviate the math anxiety and avoidance that are characteristic of girls at these ages, resulting in their disproportionately small numbers in high-level mathematics courses and math-related careers.

Over the past two years, the Board has provided advice and assistance to the MATHCO staff as it has conceived, developed, and validated these materials. We are confident that our enthusiasm for this project will be shared by educators throughout the country.

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MODULE 2 OVERVIEW

Module 2 is introduced by a 19 1/2-minute filmstrip audiovisual entitled "Patterns, Sequences, and Equations." This highly aesthetic presentation synthesizes the overall concept of the Math and Language/Fine Arts module: that the world is so very vast and complicated that it is impossible for one's mind to figure it all out. Yet by turning big problems into smaller ones, looking for patterns, and substituting those things we do understand for those we do not, we can learn to explore the world's complexities. This presentation provides motivation for the module's activities, which show the similarity of equations, substitutions, patterns, and sequences in mathematics, music, art, poetry, sentence structure, and aspects of drama.

Some of the vocabulary words and concepts explored in this presentation may be quite challenging or abstract for some students. Because these concepts may present difficulties for middle school students, it is strongly recommended that the teacher review some of the vocabulary from the audiovisual script with the students before the presentation is viewed.

The MATHCO activities for Module 2 are as follows:

1. Equations and Substitutions
2. Art/Color Theory Equations
3. Language Arts/Basic Grammar
4. Patterns and Sequences
5. Art and Music
6. Language Arts/Speech Communication
7. Language Arts/Poetry
8. Language Arts/Composition
9. Fractions/Math
10. Fractions/Language Arts
11. Graphs and Fractions/Music
12. Graphs and Fractions/Art and Drama
13. Graphs, Charts, Fractions/Drama
14. Making a Music Computer
15. Using a Music Computer

The above activities may be done in any order that the teacher wishes. However, it should be noted that Activities 1 through 3, 4 through 8, and 9 through 13 do follow sequential patterns, with Activities 1, 4, and 9 being leadoff activities for each group. It should also be noted that Activity 14 must precede Activity 15, as the students must first make the instrument they will use to complete Activity 15. Activity 13 is perhaps the most challenging of these activities. It has proved to be a most effective exercise for the teacher's most capable students.

Many math teachers have used the resources of their school's art and music teachers in presenting some of these activities. A team teaching approach to certain activities is often very effective. However, the activities have been constructed in such a way that many math teachers (even those with little or no expertise in the areas of music and art) have been successful in carrying them out with middle school students.

After students have viewed the Module 2 audiovisual, the teacher should select from Module 2 those activities that are best suited and most appropriate to his or her group of students. Some activities may be selected because they relate to the interests of the students. Others will be selected because they deal with math skills with which the students are currently working, review math skills the students should know, and/or present interdisciplinary relationships that will enhance students' appreciation of the study of mathematics.

Before using a particular activity, the teacher should review the problem sets carefully to determine their appropriateness for the students. For example, students may have difficulty working with two-digit numbers in Activity 1. Some modifications in the activities may therefore be needed to adapt them to the level of the students.

MODULE 2 AUDIOVISUAL SCRIPT

PATTERNS, SEQUENCES, AND EQUATIONS
(Math and Language/Fine Arts)

VISUAL	AUDIO
Begin audio with black frame following focus frame.	(Music)
Frame 1 - (TITLE FRAME) Patterns, Sequences, and Equations	(Music)
Frame 2 - Person is pictured standing alone facing the vastness of the great outdoors.	The world is very big. We are very small.
Frame 3 - Person is pictured with a raging storm at sea in the background.	The world is very hard. We are very vulnerable.
Frame 4 - Person is pictured with an urban landscape as background.	The world is very complicated. We are very naive.
Frame 5 - Person is pictured with a forest as background.	The world is very beautiful. We are very insensitive.
Frame 6 - Cave dweller is shown in natural habitat.	Ever since we first became aware of our minds, we have been using them to try to figure out this very big, dangerous, complicated, beautiful world.
Frame 7 - Person riding a horse in the American West is shown.	The more we understand and appreciate our world, the happier and more comfortable we feel in it.

VISUAL	AUDIO
Frame 8 - Albert Einstein is pictured with our solar system in the background.	The world is so vast that no one's mind ever has--or ever will--figure it all out. But still we try.
Frame 9 - The number two (2) is depicted in various ways; a mathematical equation is also shown.	We try by using ways and means that we do understand to help us think about the things that we don't.
Frame 10 - A Greek myth is symbolized by a chariot flying through the air.	Some people have used myths and stories to help explain the things they couldn't understand.
Frame 11 - Two figures bearing bowls of fruit.	Some people have used rituals and ceremonies to help them understand the things they couldn't explain.
Frame 12 - Symbols depicting art and drama are shown (a stage, artist at work, etc.).	Artists and dramatists create their own little worlds to show us ways to appreciate the big one.
Frame 13 - A trumpet, musical scores, and books are shown.	Writers use words to explore the world. Musicians use sound.
Frame 14 - A modern dancer and numbers are shown.	Dancers use movement. Mathematicians use numbers.
Frame 15 - Three human heads with symbols in them are shown (forms, letters, numbers).	Different minds use different methods to solve the same problems.
Frame 16 - A jigsaw puzzle is shown with one piece missing; that piece is standing apart from the almost completed whole.	One method that most minds use is to look for patterns. There is an order to the world--the way things work and fit together--if we can only see it.

VISUAL	AUDIO
Frame 17 - An early hunter is shown in a historical setting.	The first hunters saw a pattern in the feeding habits of the animals.
Frame 18 - Early farmers are shown in a historical setting.	The first farmers saw a pattern in the way the seasons changed and followed one another.
Frame 19 - An ancient astronomer is depicted.	The first astronomers saw a pattern in the stars and...
Frame 20 - An Indian medicine man is shown with a sick person.	...the first doctors saw patterns in people's lives.
Frame 21 - An 18th-century American Indian and an example of decorated pottery are shown.	Artists create patterns in their world of lines, shapes, and color.
Frame 22 - A 16th-century Oriental musician and musical symbols are shown.	The musician organizes the world's sounds and time into patterns.
Frame 23 - A novelist symbolizing the romantic period is shown.	Writers arrange words and ideas into stories that illustrate the patterns of the world.
Frame 24 - 1 2 3 4 5 + 5 4 3 2 1 6 6 6 6 6	Mathematicians seek patterns in their world of numbers.
Frame 25 - A person is shown crossing an expanse of water step by step.	By recognizing patterns in our world, we can make predictions and follow the steps that lead to our understanding and appreciation of the world. By finding patterns in our problems, we are able to solve them a step at a time.

VISUAL	AUDIO
Frame 26 - A girl is shown surrounded by her parents, friends, and boyfriend--all clamoring for her attention.	The world, when seen as one big problem, seems--and is--unsolvable.
Frame 27 - The same girl is shown with her parents, friends, and boyfriend all compartmentalized and individualized.	But the world, like all big problems, can be broken down into lots of little problems and questions that we <u>can</u> think about and answer.
Frame 28 - A picture of a rose is shown.	We'll never understand a flower. But botanists know how it grows. Scientists work to protect it. And artists help us to see its beauty.
Frame 29 - A forest at the beginning of spring is shown.	We'll never understand a May morning. But meteorologists can predict them. Environmentalists work to protect them. And musicians help us to hear its song.
Frame 30 - A family is shown picnicking beside an old tree with initials carved on it.	We'll never understand love. But psychologists know we need it. Sociologists can measure its results. And poets help us to feel its touch.
Frame 31 - The world is shown. Around it is an example of a pattern (2-4-6-), a substitution (A + 2 = 6), and a reduction ($\frac{32}{64} = \frac{1}{2}$)	We'll never understand the world. But by turning big problems into little ones, looking for patterns, and substituting things we understand for things we don't, we can learn to explore its complexities.

VISUAL	AUDIO
Frame 32 - A girl and a boy are shown standing in front of a school building.	And though we may never find all the answers, we can always enjoy the search.
Frame 33 - CREDIT Audiovisual developers	(Music)
Frame 34 - CREDIT MATHCO developers	(Music)
Frame 35 - CREDIT MATHCO National Review Board	(Music)
Frame 36 - DISCLAIMER	(Music)
Frame 37 - THE END	(Music)

MODULE 2 ACTIVITIES

These MATHCO activities help students discover that basic mathematical concepts already familiar to them are also appropriate to elements found in the language arts and in the fine arts (music, art, and drama). Under your guidance, students will also become acquainted with careers that draw upon the math skills they will be using in these activities.

1. EQUATIONS AND SUBSTITUTIONS Page 13

   A reinforcement of basic math skills is provided as students evaluate numerical expressions, substitute variables, and solve equations.

   SKILLS USED: Addition, subtraction, multiplication, division, evaluating expressions, substituting variables, and solving equations

2. ART/COLOR THEORY EQUATIONS Page 23

   After exploring basic concepts of art color theory and color mixing, students use math techniques of evaluating expressions, substituting variables, and solving equations to solve color theory equations.

   SKILLS USED: Evaluating expressions, substituting variables, solving equations, and addition

3. LANGUAGE ARTS/BASIC GRAMMAR Page 31

   Students explore those concepts of basic English grammar and sentence structure that relate to evaluating expressions, substituting variables, and solving equations.

   SKILLS USED: Evaluating expressions, making substitutions, and solving equations

4. PATTERNS AND SEQUENCES Page 39

   Students are presented with a series of numerical patterns and sequences, and are challenged to interpret them.

   SKILLS USED: Analysis of numerical information, multiplication, division, subtraction, and addition

5. ART AND MUSIC Page 47

Concrete musical and artistic images of patterns and sequences are analyzed by students.

SKILLS USED: Analysis of visual forms and images

6. LANGUAGE ARTS/SPEECH COMMUNICATION Page 57

An exercise in encoding and decoding messages reinforces students' awareness of another arrangement of patterns and sequences.

SKILLS USED: Analysis of coded information, addition, and subtraction

7. LANGUAGE ARTS/POETRY Page 67

Students work with poetic rhyming patterns and sequences to reach an awareness of how certain language and mathematical concepts are related.

SKILLS USED: Analysis of verbal and visual material

8. LANGUAGE ARTS/COMPOSITION Page 77

Students are brought face-to-face with paragraph construction, and they use concepts of logical sequence, ordering, and structural relationships of words to bring understanding and meaning to these groups of words.

SKILLS USED: Analysis of written information and sequential ordering

9. FRACTIONS/MATH Page 85

A review of fractions reinforces the concept of a whole being made up of its component parts.

SKILLS USED: Addition, subtraction, multiplication, and division of fractions

10. FRACTIONS/LANGUAGE ARTS Page 95

Students discover than when prefixes and/or suffixes are added to root words, new words with different meanings are formed.

SKILLS USED: An understanding of fractions as component parts of a whole, and the ability to use a dictionary

11. GRAPHS AND FRACTIONS/MUSIC Page 105

Using musical symbols and graphs, students discover how musical time can be broken down into its component parts.

SKILLS USED: An understanding of fractions, substitution, ordering of operations, reading and constructing graphs, and following directions

12. GRAPHS AND FRACTIONS/ART AND DRAMA Page 115

Samples of design work done by artists and people involved in dramatic productions are explored by students. Students come to an understanding that most designs proceed from the simple to the more complex.

SKILLS USED: Using a ruler, adding fractions, and subtracting fractions

13. GRAPHS, CHARTS, FRACTIONS/DRAMA Page 123

Students explore the world of box office/theatre management by solving problems involving number of seats, admission pricing, and expenses incurred by theatrical productions. This is a challenging activity that is ideal for your highly capable students.

SKILLS USED: Working with large fractions, reading charts and graphs, interpreting word problems, and ordering of operations

14. MAKING A MUSIC COMPUTER Page 131

Using pattern pieces, students construct and decorate music computers, which will be used in Activity 15.

SKILLS USED: Following directions and ordering of operations

15. USING A MUSIC COMPUTER Page 139

Students use the tool they made in Activity 14 to find the answers to a variety of music theory questions. (No prior knowledge of music--by teachers or students--is necessary for successful implementation of this activity.)

SKILLS USED: Substitution, evaluation of variables, and ordering of operations

MODULE 2, NUMBER 1 - EQUATIONS AND SUBSTITUTIONS

Teacher Activity Sheet

Overview

Your students will gain experience in evaluating numerical expressions, in substituting variables, and in solving equations, while at the same time reinforcing their basic math skills.

Math Skills Your Students Will Need

Addition, subtraction, multiplication, division, evaluating expressions, substituting variables, and solving equations.

Time Allotment

One to two class periods.

Objectives

Your students will:

1. Gain experience in evaluating expressions.
2. Gain experience in substituting variables.
3. Gain experience in solving equations.
4. Reinforce their skills in addition, subtraction, multiplication, and division.

Materials Your Class Will Need

Equations and Substitutions Worksheets and pencils.

Vocabulary

expression:	a mathematical statement (or sentence) that includes elements (numbers and/or letters) and operations (such as addition, subtraction, multiplication, and division)
equation:	an expression that has equal sides
evaluate:	to solve or compute
variable:	a symbol or element that can change
substitute:	to use a word, number, or phrase in place of another

Self-Concept Builder

Your students will be able to use skills they have previously acquired while being introduced to new algebraic concepts.

Activity

1. In a way best suited to your particular class, go over the directions and examples heading each section of the Equations and Substitutions Worksheet.
2. Your students should work the problems on their own, with you providing additional explanations, if necessary.
3. Review the appropriateness of the problem sets presented. Some of your pupils may not be able to work with two-digit numbers by rote.
4. Discuss with your students the connections between this activity and mathematics.

Occupations Related to This Activity

What occupations might use an activity similar to this one? Have your students complete the career section on their Activity Sheets. After class discussion, they should add these occupations to the list:

MATHEMATICIAN	HOME ECONOMIST	COMPUTER PROGRAMMER
STATISTICIAN	CHEMIST	HOMEMAKER
SCIENTIST	CHEF	MATH OR SCIENCE TEACHER

Discuss the kinds of courses people going into these occupations should take in high school. Have your students add these courses to their Activity Sheets.

Stress that men and women can be equally successful in most careers, if they are qualified.

Suggested Independent Activities

(These suggestions appear on Student Activity Sheets.)

See if you can find some recipes in cookbooks that allow for substitution of ingredients.

MODULE 2, NUMBER 1 - EQUATIONS AND SUBSTITUTIONS

Student Activity Sheet

Your Name _____ Date _____

Overview

This activity will help you discover how to substitute known items for unknown items, analyze problems, and learn to solve sentence problems and equations. You will also get practice in using your basic math skills.

Math Skills You Need to Remember

Addition, subtraction, multiplication, division, evaluating expressions, substituting variables, and solving equations.

Things You Will Need

Equations and Substitutions Worksheet and a pencil.

Vocabulary

expression:	a mathematical statement (or sentence) that includes elements (numbers and/or letters) and operations (such as addition, subtraction, multiplication, and division)
equation:	an expression that has equal sides
evaluate:	to solve or compute
variable:	a symbol or element that can change
substitute:	to use a word, number, or phrase in place of another

When You Finish You Will Be Able To

Substitute known items for unknown ones, analyze problems, and learn to solve sentence problems and equations.

Activity

See Worksheet.

Occupations Related to This Activity

(You may check the MATHCO Career Wall Charts to get more information about a career in which you are interested.)

OCCUPATIONS	SUBJECTS NEEDED IN HIGH SCHOOL

Are you interested in any of these careers? Remember, you can be anything you want to be--if you are qualified.

Women and men can do the same jobs with equal success. Can't both men and women enter each of the occupations you have listed above?

Exploring on Your Own

Find recipes in cookbooks that allow for substitution of ingredients.

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MODULE 2, NUMBER 1 - EQUATIONS AND SUBSTITUTIONS

Worksheet

ADDITION EQUATIONS

Example: $N + 47 = 83$ — Find "N." ("N" could be any letter--it's the variable.)

$N + 47 \underline{- 47} = 83 \underline{- 47}$ — Subtract 47 from each side of the equation.

$N = 36$

Check: Substitute 36 for "N."
Do $36 + 47 = 83$? YES.

Set A: Find Each Missing Number

1. $X + 19 = 50$
   $X =$ *31*

2. $245 + A = 560$
   $A =$ *315*

3. $22 + N = 48$
   $N =$ *26*

4. $53 = D + 27$
   $D =$ *26*

5. $100 = 87 + B$
   $B =$ *13*

6. $Q + 37 = 94$
   $Q =$ *57*

7. $C + 18 = 38$
   $C =$ *20*

8. $71 + T = 82$
   $T =$ *11*

9. $G + 25 = 87$
   $G =$ *62*

10. $18 + Y = 75$
    $Y =$ *57*

SUBTRACTION EQUATIONS

Example: $X - 86 = 137$ — Find "X."

$X - 86 \underline{+ 86} = 137 \underline{+ 86}$ — Add 86 to each side of the equation.

$X = 223$

Check: Substitute 223 for "X."
Does $223 - 86 = 137$? YES.

Set B: Find Each Missing Number

1. N - 52 = 85
   N = *137*

2. 94 = G - 32
   G = *126*

3. K - 7 = 23
   K = *30*

4. D - 42 = 42
   D = *84*

5. 67 = C - 14
   C = *81*

6. B - 23 = 14
   B = *37*

7. V - 37 = 6
   V = *43*

8. 48 = W - 17
   W = *65*

9. 31 = Y - 58
   Y = *89*

10. D - 66 = 23
    D = *89*

MULTIPLICATION EQUATIONS

Example: $5N = 30$ Find "N."

$\frac{5N}{5} = \frac{30}{5}$ Divide each side of the equation by 5.

$N = 6$

Check: Substitute 6 for "N."
Does 5 x 6 = 30? YES.

Set C: Find Each Missing Number

1. 7N = 49
   N = *7*

2. 8A = 112
   A = *14*

3. 25E = 25
   E = *1*

4. 3C = 78
   C = *26*

5. $6Z = 150$

$Z =$ *25*

6. $8D = 120$

$D =$ *15*

7. $4B = 108$

$B =$ *27*

8. $3X = 36$

$X =$ *12*

9. $9B = 63$

$B =$ *7*

10. $6E = 600$

$E =$ *100*

DIVISION EQUATIONS

Example: $\frac{X}{5} = 20$ Find "X."

$5 \times \frac{X}{5} = 5 \times 20$ Multiply each side of the equation by 5.

$X = 100$

Check: Substitute 100 for "X."
Does $100 \div 5 = 20$? YES.

Set D: Find Each Missing Number

1. $\frac{X}{21} = 14$

$X =$ *294*

2. $\frac{N}{25} = 3$

$N =$ *75*

3. $\frac{W}{13} = 13$

$W =$ *169*

4. $\frac{K}{12} = 9$

$K =$ *108*

5. $\frac{N}{15} = 5$

$N =$ *75*

6. $\frac{E}{4} = 14$

$E =$ *56*

7. $\frac{S}{4} = 20$

$S =$ *80*

8. $\frac{V}{3} = 25$

$V =$ *75*

9. $2 = \frac{M}{45}$

$M =$ *90*

10. $10 = \frac{X}{25}$

$X =$ *250*

Set E: Evaluate These Expressions If: A = 19 X = 2
B = 5 Y = 52

1. 17 + X + 8 = 27
2. A + 11 = 30
3. 48 + B = 53
4. 60 + Y = 112
5. 9 + A + B = 33
6. 2 + B = 7
7. 15 + X + Y = 69
8. X + Y = 54
9. A + 4 + Y = 75
10. X + 60 + Y = 114

Set F: Evaluate These Expressions If: G = 45 T = 4
H = 2 U = 1

1. G - 16 - T = 25
2. 36 - H = 34
3. T - 3 = 1
4. T - U = 3
5. 3 - U = 2
6. 45 - G = 0
7. 42 - 4 - T = 34
8. T - 2 = 2
9. G - H = 43
10. G - 32 - H = 11

Set G: Evaluate These Expressions If: C = 14 K = 1
D = 3 N = 10

1. 26C = 364
2. 4CD = 168
3. 8C = 112
4. 2D = 6
5. CN = 140
6. 16K = 16
7. 25D = 75
8. 7N = 70
9. 3D = 9
10. 12KN = 120

Set H: Evaluate These Expressions If: M = 2 W = 10
P = 5 Z = 50

1. $\frac{M}{4}$ = 1/2
2. $\frac{M}{P}$ = 2/5
3. $\frac{100}{W}$ = 10
4. $\frac{Z}{W}$ = 5

5. $\frac{25}{P} = \underline{5}$

6. $\frac{W}{M} = \underline{5}$

7. $\frac{200}{P} = \underline{40}$

8. $\frac{P}{25} = \underline{1/5}$

9. $\frac{300}{Z} = \underline{6}$

10. $\frac{18}{M} = \underline{9}$

MODULE 2, NUMBER 2 - ART/COLOR THEORY EQUATIONS

Teacher Activity Sheet

Overview

Your students will gain experience in evaluating expressions, substituting variables, and solving equations. They will be introduced to the concepts of color theory and color mixture in art.

Math Skills Your Students Will Need

Evaluating expressions, substituting variables, solving equations, and addition.

Time Allotment

One class period.

Objectives

Your students will:

1. Gain experience in evaluating expressions.
2. Gain experience in substituting variables.
3. Gain experience in solving equations.
4. Gain experience in addition.
5. Be introduced to color mixing and theory.
6. Be introduced to the vocabulary of color.

Materials Your Class Will Need

Art/Color Theory Equations Information Sheets and Worksheets and pencils. (Optional: Paint, brushes, paper, and food coloring.)

Vocabulary

formula:	a set of symbols that expresses a rule
expression:	a statement including elements and operations
equation:	an expression that includes "equals"
evaluate:	to figure out or solve

variable:	a symbol that can change
substitute:	to use something in place of another
primary colors:	the basic colors, from which all other colors are made: red, yellow, and blue
secondary colors:	colors made by mixing two primary colors in equal amounts: green, violet, and orange
tertiary colors:	the two-name colors made by mixing primary colors in unequal amounts, for example, red-orange, blue-green
neutrals:	colors made by mixing all three primary colors together

Self-Concept Builder

Your students will become more aware of and sensitive to the colors in their environment. (Students may enjoy experimenting with mixing pigments according to the formula.)

Activity

1. See Art/Color Theory Equations Information Sheet.

   (Note: You will need food coloring in the three primary colors. These should be mixed in clear bottles so that students can witness color changes. It is suggested that your class watch as you make the color changes. Encourage your students to discuss each "formula" as you demonstrate.)

2. Students should then complete their Worksheets.
3. Discuss with your students the connections between this activity and mathematics.

Occupations Related to This Activity

What occupations might use an activity similar to this one? Have your students complete the career section on their Activity Sheets. After class discussion, they should add these occupations to the list:

ARTIST
FABRIC DESIGNER
INTERIOR DECORATOR
CHEMIST
PAINT STORE MANAGER/EMPLOYEE
PROFESSIONAL HOUSE PAINTER
ART TEACHER
LABORATORY TECHNICIAN

Discuss the kinds of courses people going into these occupations should take in high school. Have your students add these courses to their Activity Sheets.

Stress that women and men can be equally successful in most careers, if they are qualified.

Suggested Independent Activities

(These suggestions appear on Student Activity Sheets.)

1. Use paints to experiment with color mixtures.
2. Discover how our eyes work to mix colors.
3. Make some discoveries about color schemes.
4. Use your knowledge about colors to make a painting of your own creation.

MODULE 2, NUMBER 2 - ART/COLOR THEORY EQUATIONS

Student Activity Sheet

Your Name _____ Date _____

Overview

This activity will help you gain experience in solving equations by substituting known elements for unknown elements. You will also discover how colors are made from formulas and how to make many new colors from a few basic ones.

Math Skills You Need to Remember

Addition, evaluating expressions, substituting variables, and solving equations.

Things You Will Need

Art/Color Theory Equations Information Sheet and Worksheet and a pencil. (Your teacher may also provide paint, brushes, paper, and food coloring for this activity.)

Vocabulary

formula:	a set of symbols that expresses a rule
expression:	a statement including elements and operations
equation:	an expression that includes "equals"
evaluate:	to figure out or solve
variable:	a symbol that can change
substitute:	to use something in place of another
primary colors:	the basic colors, from which all other colors are made: red, yellow, and blue
secondary colors:	colors made by mixing two primary colors in equal amounts: green, violet, and orange
tertiary colors:	the two-name colors made by mixing primary colors in unequal amounts, for example, red-orange, blue-green
neutrals:	colors made by mixing all three primary colors

When You Finish You Will Be Able To

Solve equations and mix colors.

Activity

1. Read Information Sheet.
2. Complete Worksheet.

Occupations Related to This Activity

(You may check the MATHCO Career Wall Charts to get more information about a career in which you are interested.)

OCCUPATIONS	SUBJECTS NEEDED IN HIGH SCHOOL

Are you interested in any of these careers? Remember, you can be anything you want to be--if you are qualified.

Women and men can do the same jobs with equal success. Can't both women and men enter each of the occupations you've listed above?

Exploring on Your Own

1. Use paints to experiment with color mixtures.
2. Discover how our eyes work to mix color.
3. Make some discoveries about color schemes.
4. Use your knowledge about colors to make a painting of your own creation.

MODULE 2, NUMBER 2 - ART/COLOR THEORY EQUATIONS

Information Sheet

PRIMARY COLORS

All colors can be made by mixing the primary colors in different combinations and different amounts.

The primary colors are RED, YELLOW, and BLUE.

In our formulas, R equals RED, Y equals YELLOW, and B equals BLUE.

SECONDARY COLORS

When two primary colors are mixed together in equal amounts, they form the secondary colors. By using red, yellow, and blue food coloring, you can easily see these changes taking place.

The secondary colors are GREEN, ORANGE, and VIOLET.

In our formulas, G equals GREEN, O equals ORANGE, and V equals VIOLET.

Take a look at these formulas. Remember, two primary colors mixed together in equal amounts form the secondary colors.

R + Y = O	Y + B = G	B + R = V
O = Y + R	G = B + Y	V = R + B

TERTIARY COLORS

When two primary colors are mixed in unequal amounts, they form the tertiary colors. Tertiary colors always have double names made up of a primary and a secondary color, such as blue-green.

The formula for tertiary colors works like this:

R + R + Y = ?	Red + Red + Yellow = ?
R + (R + Y) = ?	Red + (Red and Yellow combined) = ?
R + (O) = ?	Red + (Orange) = ?
R + O = RO	Red + Orange = Red-Orange

When you solve equations using tertiary colors, always separate them into their components. For example:

RO + Y = ?	Red-Orange + Yellow = ?
R + O + Y = ?	Look for primary colors to combine.
R + Y + O = ?	You know that Red + Yellow equals Orange, so move these letters next to each other.
(R + Y) + O = ?	(Orange) + Orange = ?
O + O = O	Orange + Orange = Orange

NEUTRAL COLORS

When you have more than two different primary colors in a formula, they cancel each other out and you are left with a neutral color. Always remember that secondary colors are really two primary colors.

In our formulas, N equals NEUTRAL.

Here are three examples of formulas yielding a neutral color:

R + B + Y = N

B + O = N

B + (R + Y) = N

MODULE 2, NUMBER 2 - ART/COLOR THEORY EQUATIONS

Worksheet

Solve these color theory equations:

1. R + B = *V*
2. Y + R = *O*
3. B + *Y* = G
4. 2R + B = *RV*
5. YG + B = *G*
6. B *+* R + *B* = BV
7. 3B + 3Y = *G*
8. RO + RV = *N*
9. B + Y + *Y* = YG
10. N = Y + *V*
11. Y + RO - R = *YO*
12. V + B + R = *V*
13. RO + BG = *N*
14. R + *Y* + R = RO
15. YO + YG = *N*
16. R + BV = *V*
17. O + B = *N*
18. Y + *V* = N
19. BV + RV = *V*
20. RO + BV + YG = *N*

MODULE 2, NUMBER 3 - LANGUAGE ARTS/BASIC GRAMMAR

Teacher Activity Sheet

Overview

Your students will gain experience in evaluating expressions, substituting variables, and solving equations. They will also explore basic grammar and sentence structure.

Math Skills Your Students Will Need

Evaluating expressions, substituting variables, solving equations, addition, subtraction, multiplication, and division.

Time Allotment

One class period.

Objectives

Your students will:

1. Gain experience in evaluating expressions.
2. Gain experience in substituting variables.
3. Gain experience in solving equations.
4. Gain experience in recognizing formulas.
5. Be able to identify and use prepositions.
6. Recognize and use subjects, verbs, linking verbs, direct objects, and predicate adjectives.
7. Write simple sentences containing:
   a. subject and verb.
   b. subject, verb, and direct object.
   c. subject, linking verb, and predicate adjective.

Materials Your Class Will Need

Language Arts/Basic Grammar Worksheets and pencils.

Vocabulary

preposition:	a word that shows a relationship (under, over)
subject:	a name word; what the sentence is about (boy, girl)
verb:	an action word (ran, jumps)
linking verb:	a word that shows state of being (is, was)
predicate adjective:	a word that describes the subject, and comes after a linking verb (The building is tall)
direct object:	a word that receives the action of the verb (She opened the door)

Self-Concept Builder

Your students will be able to apply their math skills to the analysis of sentence structure. They will have an opportunity for creativity and originality as they write their own sentences.

Activity

1. See Worksheets.
2. Discuss with your students the connections between this activity and mathematics.

Occupations Related to This Activity

What occupations might use an activity similar to this one? Have your students complete the career section on their Activity Sheets. After class discussion, they should add these occupations to the list:

WRITER	GRAMMARIAN
JOURNALIST	EDITOR
TEACHER	SECRETARY

Discuss the kinds of courses people going into these occupations should take in high school. Have your students add these courses to their Activity Sheets.

Stress that men and women can be equally successful at most careers, if they are qualified.

Suggested Independent Activities

(These suggestions appear on Student Activity Sheets.)

1. Look through the newspaper, where clear, concise writing is important. See how many examples of the three sentence formulas you can find in the headlines or within a story.
2. Proofread your homework for other classes. Make sure you haven't left out any essential elements in your sentences.

MODULE 2, NUMBER 3 - LANGUAGE ARTS/BASIC GRAMMAR

Student Activity Sheet

Your Name _____ Date _____

Overview

This activity will help you to realize more clearly that there is a formula to constructing complete sentences. You will also have a basic review of the parts of speech used in our language.

Math Skills You Need to Remember

Evaluating expressions, substituting variables, solving equations, addition, subtraction, multiplication, and division.

Things You Will Need

Language Arts/Basic Grammar Worksheet and a pencil.

Vocabulary

preposition:	a word that shows a relationship (under, over)
subject:	a name word; what the sentence is about (boy, girl)
verb:	an action word (ran, jumps)
linking verb:	a word that shows state of being (is, was)
predicate adjective:	a word that describes the subject, and comes after a linking verb (The building is tall)
direct object:	a word that receives the action of the verb (She opened the door)

When You Finish You Will Be Able To

Substitute words that will change the way you approach problems. You will also be able to recognize sentence formulas and create your own sentences by using these formulas.

Activity

See Worksheet.

Occupations Related to This Activity

(You may check the MATHCO Career Wall Charts to get more information about a career in which you are interested.)

OCCUPATIONS	SUBJECTS NEEDED IN HIGH SCHOOL

Are you interested in any of these careers? Remember, you can be anything you want to be--if you are qualified.

Women and men can do the same jobs with equal success. Can't both women and men enter each of the occupations you've listed above?

Exploring on Your Own

1. Look through the newspaper, where clear, concise writing is important. See how many examples of the three sentence formulas you can find in the headlines or within a story.
2. Proofread your homework for other classes. Make sure you haven't left out any essential elements in your sentences.

MODULE 2, NUMBER 3 - LANGUAGE ARTS/BASIC GRAMMAR

Worksheet

Prepositions are words that we use to relate objects to us or to other things. They usually fit this pattern:

The squirrel ran X the tree. "X" = the preposition

The X could be any number of words: under, up, around, into, from, through, etc.

By substituting different prepositions, we change the meanings of sentences and of math problems. Rewrite the following expressions as math statements and solve any that turn out to be math problems. The first one has been done for you.

PREPOSITIONS

1. over — 2 over 4 = $\frac{2}{4}$ or $\frac{1}{2}$

(Note: Any other responses that students can justify are also acceptable.)

2. from — 2 from 4 = *4 - 2 = 2*
3. with — 2 with 4 = *2 + 4 = 6*
4. into — 2 into 4 = *4 ÷ 2 = 2*
5. by — 2 by 4 = *4 x 2 = 8*
6. before — 2 before 4 = *2 + 4 = 6*
7. after — 2 after 4 = *4 + 2 = 6*
8. out of — 2 out of 4 = *4 - 2 = 2*
9. through — 2 through 4 = *2, 3, 4*
10. under — 2 under 4 = $\frac{4}{2} = 2$
11. to — 2 to 4 = *2, 3, 4 or* $\frac{2}{4}$ *(ratio)*

When we communicate, we usually use sentences. There are formulas for writing sentences. Three of the most common are:

1. S + V = sentence
2. S + V + DO = sentence
3. S + LV + PA = sentence

The variables in the above formulas are:

S = subject	what is being talked about
V = verb	the action word
DO = direct object	what receives the action
LV = linking verb	shows a state of being
PA = predicate adjective	describes the subject; is found after a linking verb

Here are some substitutions for these variables:

S = dog V = ran or chased DO = ball LV = is PA = large

Now, take a look at some sentences that use these substitutions:

Formula 1. S + V = sentence
The dog ran.

Formula 2. S + V + DO = sentence
The dog chased the ball.

Formula 3. S + LV + PA = sentence
The dog is large.

Set A: In Each Blank, Write the Formula Used in the Sentence

1. _____*S + V*_____ The monkey danced.
2. _____*S + LV + PA*_____ John is considerate.
3. _____*S + V + DO*_____ Cathy plays soccer.
4. _____*S + V + DO*_____ The cat chased the mouse.

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5. *S + LV + PA* Sally is friendly.

6. *S + LV + PA* My dog is tiny.

7. *S + V + DO* Alan caught the baseball.

8. *S + V* The horse ate.

9. *S + LV + PA* The car is dirty.

10. *S + V + DO* My brother plays the piano.

Set B: In Each Blank, Tell Which Variable Is Underlined

1. *PA - predicate adjective* George is playful.

2. *S - subject* Jean laughs.

3. *DO - direct object* Mindy eats pizza.

4. *V - verb* Freddy played checkers.

5. *LV - linking verb* Beverly is clever.

Set C: Solve These Equations. Make Up and Write Your Own Sentences, Substituting for the Variables and Using the Formulas

1. S + V = _____

2. S + LV + PA = _____

3. S + V + DO = _____

4. S + LV + PA = _____

5. S + V + DO = _____

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MODULE 2, NUMBER 4 - PATTERNS AND SEQUENCES

Teacher Activity Sheet

Overview

Your students will gain experience in recognizing and using patterns and sequences in number sets.

Math Skills Your Students Will Need

Analysis of numerical information, multiplication, division, subtraction, and addition.

Time Allotment

Two class periods.

Objectives

Your students will:

1. Search for and identify numerical patterns.
2. Identify and use numerical sequential relationships.
3. Solve sequential problems.
4. Gain experience in manipulating numbers.
5. Develop analytical skills.
6. Reinforce skills in multiplication, division, addition, and subtraction.

Materials Your Class Will Need

Patterns and Sequences Worksheets and pencils.

Vocabulary

sequence:	a series; one thing coming after another
pattern:	a predictable sequence based upon repetition of elements and/or procedures
elements:	things that are essential or necessary for making or doing something; component parts
procedure:	the way of doing something (adding, subtracting, multiplying, and dividing)

repetition: using or doing something more than once

relationship: the way one element compares to or works with another

Self-Concept Builder

Your students will work independently to demonstrate their ability to recognize numerical sequences and use basic math skills. Your students may not all work at the same pace, so be careful to avoid making the activity a speed contest.

Activity

1. See Worksheets.
2. Discuss with your students the connections between this activity and mathematics.

Occupations Related to This Activity

What occupations might use an activity similar to this one? Have your students complete the career section on their Activity Sheets. After class discussion, they should add these occupations to the list:

MATHEMATICIAN	SURVEYOR	BRICKLAYER
COMPUTER PROGRAMMER	ARCHITECT	MATH TEACHER
SYSTEMS ANALYST	ARTIST	

Discuss the kinds of courses people going into these occupations should take in high school. Have your students add these courses to their Activity Sheets.

Stress that women and men can be equally successful in most careers, if they are qualified.

Suggested Independent Activities

(These suggestions appear on Student Activity Sheets.)

Develop your own numerical sequences and/or solve those developed by your classmates.

MODULE 2, NUMBER 4 - PATTERNS AND SEQUENCES

Student Activity Sheet

Your Name _____ Date _____

Overview

This activity will help you develop your skills of observation, analysis, reasoning, and computation.

Math Skills You Need to Remember

Addition, subtraction, multiplication, division, and analysis of numerical information.

Things You Will Need

Patterns and Sequences Worksheet and a pencil.

Vocabulary

sequence:	a series; one thing coming after another
pattern:	a predictable sequence based upon repetition of elements and/or procedures
elements:	things that are essential or necessary for making or doing something; component parts
procedure:	the way of doing something (adding, subtracting, multiplying, and dividing)
repetition:	using or doing something more than once
relationship:	the way one element compares to or works with another

When You Finish You Will Be Able To

Recognize patterns and relationships in your numerical world.

Activity

See Worksheet. This activity may seem strange to you at first, but it's really fun when you get into it. Don't worry if some of your classmates seem to be working faster than you are. The object of this activity is to figure out the pattern, not to see how fast you can whiz along. Have fun!

Occupations Related to This Activity

(You may check the MATHCO Career Wall Charts to get more information about a career in which you are interested.)

OCCUPATIONS	SUBJECTS NEEDED IN HIGH SCHOOL
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Are you interested in any of these careers? Remember, you can be anything you want to be--if you are qualified.

Women and men can do the same jobs with equal success. Can't both women and men enter each of the occupations you've listed above?

Exploring on Your Own

Develop your own numerical sequences and/or solve those developed by your classmates.

MODULE 2, NUMBER 4 - PATTERNS AND SEQUENCES

Worksheet

Find each pattern and continue the sequence by as many numbers as you can. On the lines below each sequence, explain how the pattern works. The first one is done for you.

1. 1 - 3 - 5 - 7 - 9 - 11 - 13 - 15 - 17 - 19 - 21 - 23 - 25

   You count by two to get the next number.

2. 1 - 1 - 2 - 3 - 5 - 8 - *13 - 21 - 34 - 55 - 89 - 144*

   Add the last two numbers to get the next number.

3. 3 - 6 - 9 - 12 - *15- 18 - 21 - 24 - 27 - 30 - 33 - 36*

   Add three to get the next number.

4. 1 - 3 - 9 - 27 - 81 - *243 - 729 - 2,187 - 6,561 - 19,683*

   Multiply each number by three to get the next number.

5. 1 - 3 - 6 - 10 - 15 - *21 - 28 - 36 - 45 - 55 - 66 - 78 - 91*

   Add two, then add three, then add four, then add five, etc.

6. 6 - 13 - 20 - 27 - *34 - 41 - 48 - 55 - 62 - 69 - 76*

   Add seven to get the next number.

7. 72 - 63 - 54 - *45 - 36 - 27 - 18 - 9 - 0*

   Subtract nine to get the next number; or it follows the pattern:

   9 x 8, 9 x 7, 9 x 6, 9 x 5, 9 x 4, etc.

8. 2 - 4 - 6 - 8 - *10 - 12 - 14 - 16 - 18 - 20 - 22 - 24 - 26*

Add two to get the next number.

9. 2 - 11 - 20 - 29 - *38 - 47 - 56 - 65 - 74 - 83 - 92 - 101*

Add nine to get the next number.

10. 43 - 37 - 31 - 25 - *19 - 13 - 7 - 1*

Subtract six to get the next number.

11. 20 - 10 - 5 - 2½ - *1¼ - 5/8 - 5/16 - 5/32*

Divide by two to get the next number.

12. 3 - 6 - 4 - 8 - 6 - *12 - 10 - 20 - 18 - 36 - 34*

It follows the pattern: double the first number, then subtract two.

13. 100 - 1 - 99 - 2 - 98 - *3 - 97 - 4 - 96 - 5 - 95 - 6 - 94*

Subtract one to get the first, third, fifth, etc., numbers; add one to get the second, fourth, sixth, etc., numbers.

14. 1 - 5 - 6 - 11 - 17 - *28 - 45 - 73 - 118 - 191*

Add the last two numbers to get the next number.

15. 88 - 44 - 22 - *11 - 5½ - 2 3/4 - 1 3/8*

Divide by two to get the next number.

16. 123 - 456 - 789 - 101 - 112 - *131 - 415 - 161 - 718 - 192*

To find the next number, count by ones and maintain a pattern of three-digit numbers.

17. 0 - 50 - 5 - 45 - 10 - *40 - 15 - 35 - 20 - 30 - 25 - 25*

Add five to get the first, third, fifth, etc., numbers; subtract five to get the second, fourth, sixth, etc., numbers.

18. 1 - 2 - 4 - 7 - 11 - 16 - *22 - 29 - 37 - 46 - 56 - 67 - 79*

It follows the pattern: add one to the first number to get the second number; add two to the second number, etc.

19. 20 - 19 - 17 - 14 - 10 - *5 - (-1) - (-8) - (-16)*

Subtract one from the first number to get the second, subtract two from the second number, then three, then four, etc.

20. 2 - 4 - 16 - 256 - *65,536 - 4,294,967,296*

Square each number to get the next number.

In this next section, decide which number in each sequence does not fit the pattern. On the lines below each sequence, explain why the number doesn't fit the sequence.

1. 10 - 21 - 32 - 43 - 53 - 65 - 76 - 87 *53*

The other numbers are formed by adding eleven to the previous number.

2. 8 - 16 - 24 - 30 - 40 - 48 - 56 - 64 *30*

The other numbers are multiples of eight.

3. 3 - 6 - 9 - 12 - 16 - 18 - 21 - 24 *16*

The other numbers are multiples of three.

4. 5 - 25 - 4 - 20 - 3 - 16 - 2 - 10 *16*

Sixteen does not follow the pattern of subtracting five from the second, fourth, sixth, etc., numbers.

5. 12 - 21 - 34 - 43 - 56 - 65 - 67 - 87 *67*

The inconsistent number does not fit the pattern of counting by ones to form two-digit numbers and then inverting them.

6. 2 - 3 - 10 - 12 - 13 - 18 - 20 - 21 - 22 *18*

All of the other numbers use only the digits 0, 1, 2, or 3.

7. 1/2 - 2/3 - 3/4 - 4/5 - 5/6 - 6/6 - 7/8 - 8/9 *6/6*

Each numerator and denominator continues the pattern of counting by ones.

8. 3/5 - 6/4 - 15/2 - 9/5 - 3 - 12/8 *3*

All are fractions except three.

9. One - eight - eleven - eighteen - forty - eighty *forty*

When written as numbers (1-8-11-etc.), all the others contain an eight or a one.

10. 3/6 - 2/4 - 5/10 - 1/2 - 2/3 - 4/8 - 12/24 *2/3*

All the other fractions equal 1/2 when reduced to their lowest terms.

MODULE 2, NUMBER 5 - ART AND MUSIC

Teacher Activity Sheet

Overview

Your students will gain experience in recognizing and using patterns and sequential development.

Math Skills Your Students Will Need

Analysis of visual materials.

Time Allotment

One class period.

Objectives

Your students will:

1. Discover patterns in visual elements.
2. Identify sequential relationships.
3. Solve sequential problems.
4. Be introduced to basic visual elements of art and music.
5. Develop skills of observation.
6. Develop skills of analysis.
7. Perform tasks that they often encounter in standardized tests.

Materials Your Class Will Need

Art and Music Worksheets and pencils.

Vocabulary

elements:	things that are essential or necessary for making or doing something; component parts
pattern:	a predictable sequence based upon repetition of elements and/or procedures
sequence:	a series; one thing or event coming after another
repetition:	using something more than once
variation:	a change
relationship:	the way one element compares to or works with another

Self-Concept Builder

Your students will rely upon their powers of observation to solve visual "problems" that allow for some creative self-expression. They will gain experience and self-confidence in a relaxed atmosphere performing exercises that they often encounter in stressful test-taking activities.

Activity

1. See Worksheets.
2. Discuss with your students the connections between this activity and mathematics.

Occupations Related to This Activity

What occupations might use an activity similar to this one? Have your students complete the career section on their Activity Sheets. After class discussion, they should add these occupations to the list:

MUSICIAN	FILMMAKER	RESEARCHER
COMPOSER	MAPMAKER (CARTOGRAPHER)	SCIENTIST
ARTIST	ARCHITECT	COMPUTER PROGRAMMER

Discuss the kinds of courses people going into these occupations should take in high school. Have your students add these courses to their Activity Sheets.

Stress that women and men can be equally successful in most careers, if they are qualified.

Suggested Independent Activities

(These suggestions appear on Student Activity Sheets.)

1. Identify visual patterns in music at home, or perhaps in music class.
2. Identify repeated patterns in music by listening (bass, phrasing, instrumentation, etc.).
3. Use stamp printing techniques to:
   a. Print a decorative pattern on a piece of material or an article of clothing (with permission, of course).
   b. Print a design using repetition of shapes and colors.
   c. Print personalized stationery using a pattern based on initials.
   d. Design gift-wrapping paper.

MODULE 2, NUMBER 5 - ART AND MUSIC

Student Activity Sheet

Your Name _____ Date _____

Overview

This activity will help you develop the skills of observation and reasoning necessary to make sense of our visual environment. It will help you learn to see things for what they are, and not necessarily what they mean or stand for. It will also introduce you to some special shapes and figures that artists and musicians look at and use in their work. Don't worry about what the symbols mean. Just look at them and try to "see" them as pictures. Remember, "One picture is worth a thousand words."

Math Skills You Need to Remember

You will need to analyze the information your eyes give you to find how the different elements relate to one another.

Things You Will Need

Art and Music Worksheet and a pencil.

Vocabulary

elements:	things that are essential or necessary for making or doing something; component parts
pattern:	a predictable sequence based upon repetition of elements and/or procedures
sequence:	a series; one thing or event coming after another
repetition:	using something more than once
variation:	a change
relationship:	the way one element compares to or works with another

When You Finish You Will Be Able To

Recognize patterns and relationships in your visual world.

Activity

See Worksheet.

Occupations Related to This Activity

(You may check the MATHCO Career Wall Charts to get more information about a career in which you are interested.)

OCCUPATIONS	SUBJECTS NEEDED IN HIGH SCHOOL
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Are you interested in any of these careers? Remember, you can be anything you want to be--if you are qualified.

Women and men can do the same jobs with equal success. Can't both women and men enter each of the occupations you've listed above?

Exploring on Your Own

1. Identify visual patterns in music at home, or perhaps in music class.
2. Identify repeated patterns in music by listening (bass, phrasing, instrumentation, etc.).
3. Use stamp printing techniques to:
   a. Print a decorative pattern on a piece of material or an article of clothing (with permission, of course).
   b. Print a design using repetition of shapes and colors.
   c. Print personalized stationery using a pattern based on initials.
   d. Design gift-wrapping paper.

MODULE 2, NUMBER 5 - ART AND MUSIC

Worksheet

In each of the following groups, which element does not fit the pattern?

1.

C

(Does not have sign 𝄞)

2.

C

(Contains a curved line)

3.

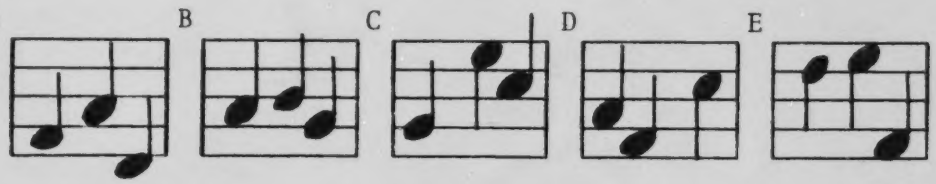
B

(Dot is not in an open space)

4.

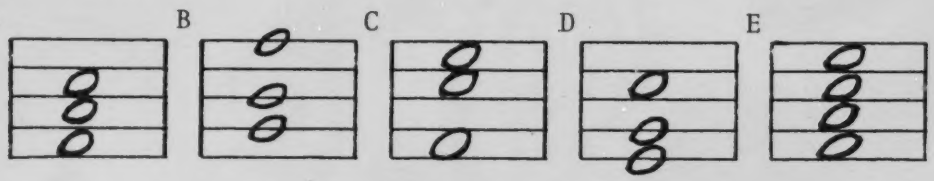
B

(No dot)

5. 

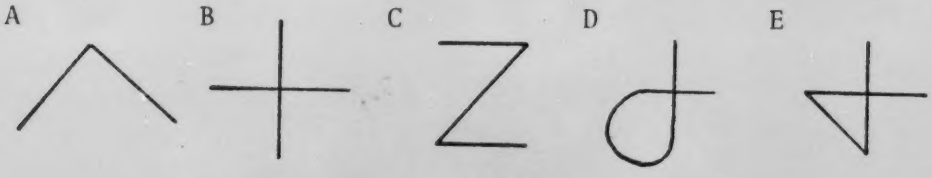
D

(Note pattern is not down, up, down)

6. 

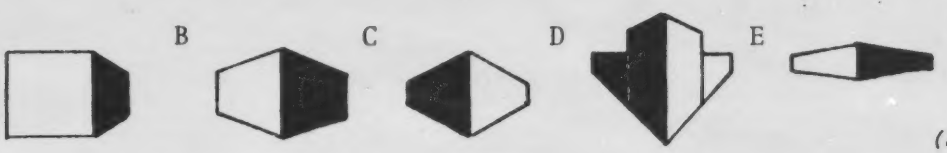
E

(Four notes, not three)

7. 

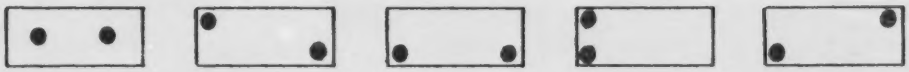
D

(Uses a curved line)

8. 

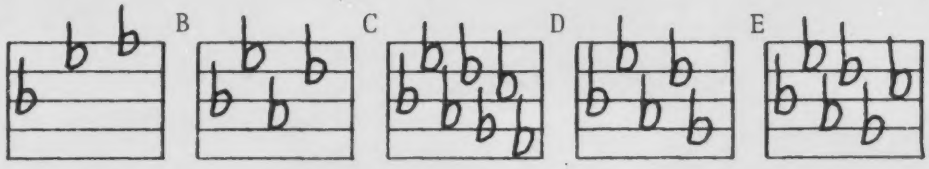
A

(Shading is not half)

9. 

A

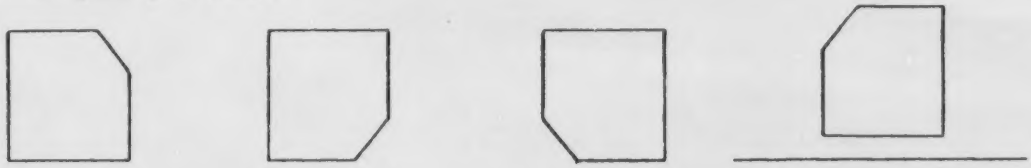
(Dots are not in corners)

10. 

A

(Note pattern is not down, up, down)

Decide what should come next in each of the following sequences. Draw it in the space provided.

1. 

2.

3.

4.

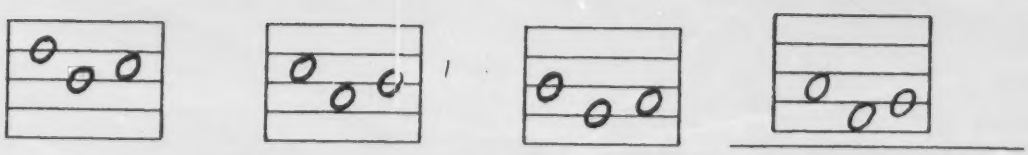
5.

6.

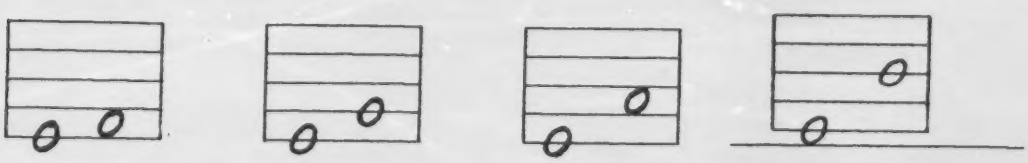
7.

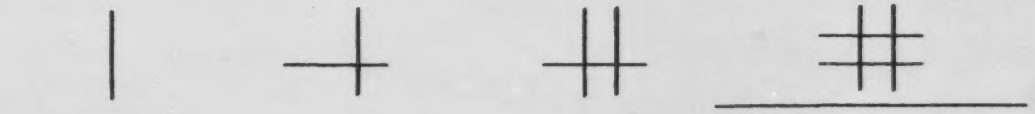
8.

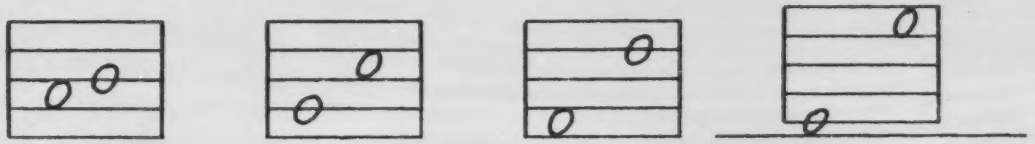
9.



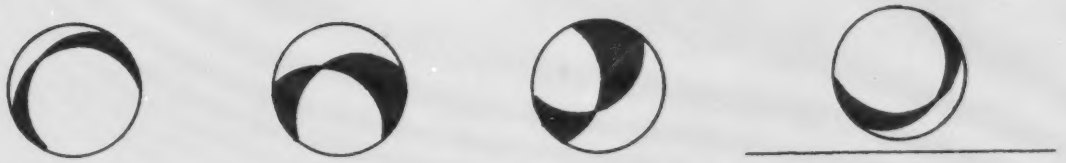
10.

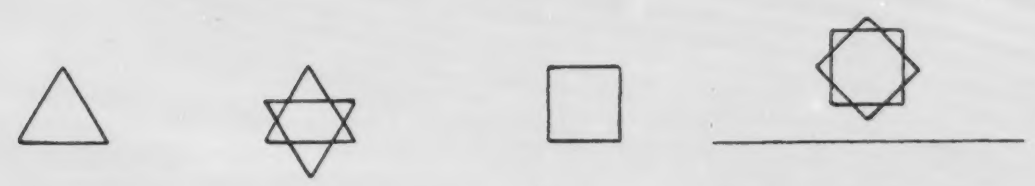


11. 

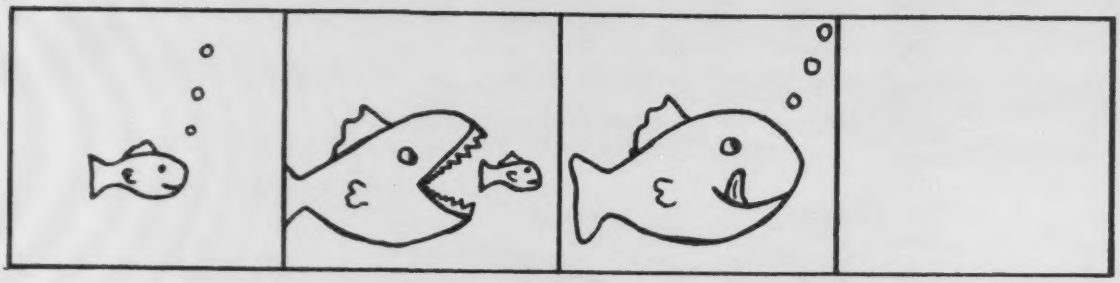
12. 

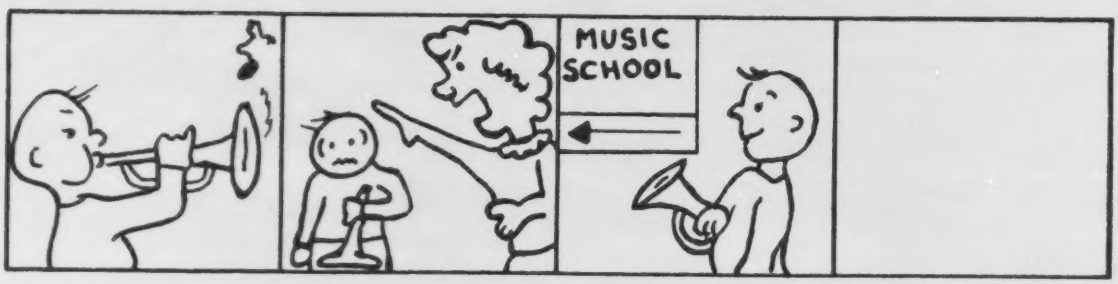
13.

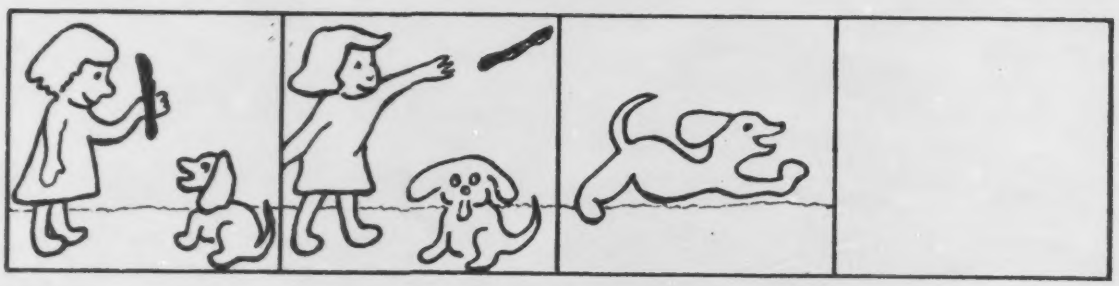
14. 

15. 

Look at the following cartoon sequences. Draw what you think happens next.





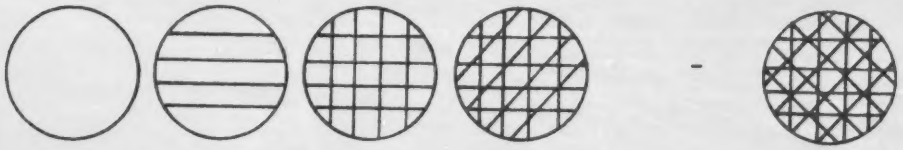


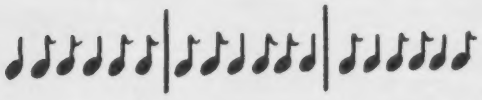
Continue these patterns:

1. AEFHI - *All alphabet letters formed with straight lines only; in order.*

2. BCDGJ - *All alphabet letters that contain a curved line; in order.*

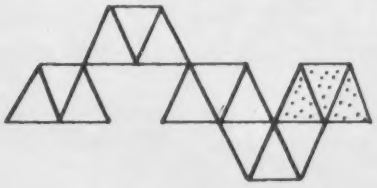
3. - *One circle, one square, two circles, one square, etc.*

4.  -

5.  - *The first note of each segment moves to the end to begin the next segment.*

6. -

7. - *Alternating feet.*

8.  - *The last three triangles repeat the beginning of this pattern; the pattern should continue from there.*

9. - *One "m," two horseshoes, one "m," etc.*

10. - *Each note moves up to the next line or space in each new bar of music.*

MODULE 2, NUMBER 6 - LANGUAGE ARTS/SPEECH COMMUNICATION

Teacher Activity Sheet

Overview

Your students will gain experience in recognizing and using patterns and sequences to encode and decode messages.

Math Skills Your Students Will Need

Analysis of coded information, addition, and subtraction.

Time Allotment

Two class periods.

Objectives

Your students will:

1. Search for and identify patterns and sequential relationships.
2. Solve sequential problems.
3. Encode and decode messages.
4. Reinforce addition and subtraction skills.
5. Develop skills of analysis.

Materials Your Class Will Need

Language Arts/Speech Communication Worksheets and pencils; the Morse code audiotape.

Vocabulary

code:	a set of signals or symbols for sending messages or giving information in a unique way
encoding:	putting regular language into a code
decoding:	putting a coded message into regular language
symbol:	something that stands for or takes the place of something else
Morse code:	a code developed by Samuel Morse for use in telegraph systems; the Morse code is made up of dots and dashes

Self-Concept Builder

Your students will develop their own coded language to communicate to a special group.

Activities

1. See Worksheets.
2. After your students have completed the first three pages of the Worksheet, play a recording of the international Morse code. Your students should "read" silently the Morse code on page 3 of the Worksheet as they listen.
3. Allow time for discussion.
4. Now play the next part of the recording, which consists of three recorded messages in international Morse code. The messages are:
   a. Careers in math are exciting for women and men.
   b. Everyone needs to take math in senior high school.
   c. The above two commercials have been presented by our sponsor, MATHCO.
5. You may also wish to present the following Communication Model to your class:

Encoder	Message	Decoder
Sender	Medium	Receiver
Decoder	Feedback	Encoder

6. Discuss with your students the connections between these activities and mathematics.

Occupations Related to These Activities

What occupations might use activities similar to these? Have your students complete the career section on their Activity Sheets. After class discussion, they should add these occupations to the list:

PUZZLE WRITER	ARCHAEOLOGIST	MILITARY OFFICER
SPY	ETYMOLOGIST	COMPUTER PROGRAMMER
TRANSLATOR	LINGUIST	

Discuss the kinds of courses people going into these occupations should take in high school. Have your students add these courses to their Activity Sheets.

Stress that women and men can be equally successful in most careers, if they are qualified.

Suggested Independent Activities

(These suggestions appear on Student Activity Sheets.)

1. Develop and use your own written code.
2. Develop a spoken code, e.g., "pig" Latin.
3. Make a list of codes you already know and use (music, signs, slang, numbers, etc.).
4. Learn of other popular codes (sign language for the deaf, signal flags, etc.).
5. Research the history and uses of codes.

MODULE 2, NUMBER 6 - LANGUAGE ARTS/SPEECH COMMUNICATION

Student Activity Sheet

Your Name _____ Date _____

Overview

This activity will help you develop unique ways of communicating. Whenever we talk or write to our friends, we are using codes and symbols. We can only communicate with people who speak the language--or know the same code we are using. By developing new codes, we can limit the number of people who can understand what we are saying.

Math Skills You Need to Remember

Addition and subtraction.

Things You Will Need

Language Arts/Speech Communication Worksheet and a pencil.

Vocabulary

code:	a set of signals or symbols for sending messages or giving information in a unique way
encoding:	putting regular language into a code
decoding:	putting a coded message into regular language
symbol:	something that stands for or takes the place of something else
Morse code:	a code developed by Samuel Morse for use in telegraph systems; the Morse code is made up of dots and dashes

When You Finish You Will Be Able To

Encode and decode messages.

Activity

See Worksheet.

Occupations Related to This Activity

(You may check the MATHCO Career Wall Charts to get more information about a career in which you are interested.)

OCCUPATIONS	SUBJECTS NEEDED IN HIGH SCHOOL

Are you interested in any of these careers? Remember, you can be anything you want to be--if you are qualified.

Women and men can do the same jobs with equal success. Can't both women and men enter each of the occupations you've listed above?

Exploring on Your Own

1. Develop and use your own written code.
2. Develop a spoken code, e.g., "pig" Latin.
3. Make a list of codes you already know and use (music, signs, slang, numbers, etc.).
4. Learn other popular codes (sign language for the deaf, signal flags, etc.).
5. Research the history and uses of codes.

MODULE 2, NUMBER 6 - LANGUAGE ARTS/SPEECH COMMUNICATION

Worksheet

D E C O D I N G

You are a secret agent in a foreign country. Your headquarters sends you the following important messages, which you must decode before you can follow the instructions. Break each code and write the decoded messages. Also, explain how each code works.

1. CLUE: M, A, T, H = 13, 1, 20, 8

MESSAGE: 12, 15, 15, 11 6, 15, 18 20, 8, 5
13, 1, 14 9, 14 20, 8, 5 2, 12, 21, 5
19, 8, 9, 18, 20.

DECODED MESSAGE: *Look for the man in the blue shirt.*

HOW THE CODE WORKS: *A = 1, B = 2, C = 3, D = 4, E = 5, F = 6, G = 7, etc.*

2. CLUE: M, A, T, H = 26, 2, 40, 16

MESSAGE: 40, 16, 10 32, 2, 38, 38, 46, 30, 36, 8
18, 38 "2, 36, 18, 40, 16, 26, 10, 40, 18, 6."

DECODED MESSAGE: *The password is "arithmetic."*

HOW THE CODE WORKS: *Divide each clue number by two, and that number represents its corresponding letter when A = 1, B = 2, C = 3, etc.*

3. CLUE: M, A, T, H = O, C, V, J

MESSAGE: O, G, G, V V, J, G N, C, F, A C, V
V, J, G V, T, C, K, P.

DECODED MESSAGE: *Meet the lady at the train.*

HOW THE CODE WORKS: *Take the letter in the code and count back two to get the decoded letter: M N O, A B C, Z A B, etc.*

4. CLUE: M, A, T, H = J, V, C, O

MESSAGE: K, R, V, A, R X, H, B, E G, V, T, L, V, P, R
H, I C, O, R G, V, E, L U, R, I, T, O.

DECODED MESSAGE: *Leave your package on the park bench.*

HOW THE CODE WORKS: *Letter the alphabet in reverse, starting with A = V, B = U, C = T, D = S, E = R, etc.*

5. CLUE: M, A, T, H = NL, BZ, US, IG

MESSAGE: MK, FD, BZ, WU, FD US, PN, XV, OM
OM, PN, XV!

DECODED MESSAGE: *Leave town now!*

HOW THE CODE WORKS: *Each letter is represented by a combination of the letter that follows it and the letter that precedes it: US = T, NL = M, DB = C, etc.*

E N C O D I N G

Use the symbols of the international Morse code to encode the following:

INTERNATIONAL
MORSE CODE

A: . _
B: _ . . .
C: _ . _ .
D: _ . .
E: .
F: . . _ .
G: _ _ .
H: . . . .
I: . .
J: . _ _ _
K: _ . _
L: . _ . .
M: _ _
N: _ .
O: _ _ _
P: . _ _ .
Q: _ _ . _
R: . _ .
S: . . .
T: _
U: . . _
V: . . . _
W: . _ _
X: _ . . _
Y: _ . _ _
Z: _ _ . .

1. Encode your full name:

2. Encode the name of your school:

3. Encode this message:

SAMUEL MORSE INVENTED THE MORSE CODE.

... ._ _ _ .._ . ._.. /

_ _ _ _ _ ._. ... . /

.. _. ..._ . _. _ . _.. /

_ .... . / _ _ _ _ _ ._. ... . /

_._. _ _ _ _.. . x

You will now hear an audiotape of the international Morse code (see page three of this Worksheet).

Now, listen to three messages given in the international Morse code. Listen closely and copy the messages using dots and dashes. Then, after you have copied all three messages, decode them to find out what the messages say.*

1.

2.

3.

*We encourage teachers to have fun figuring out this one along with students.

MODULE 2, NUMBER 7 - LANGUAGE ARTS/POETRY

Teacher Activity Sheet

Overview

Your students will gain experience in recognizing and using patterns and sequential development in verbal poetic expressions.

Math Skills Your Students Will Need

Analysis of verbal and visual materials to find patterns and sequence.

Time Allotment

One class period.

Objectives

Your students will:

1. Search for and identify patterns and sequential relationships.
2. Solve sequential problems.
3. Gain experience in working with the mechanics of poetry and creative writing.
4. Enhance the development of their analytical skills.
5. Apply to poetry the thought patterns and skills used in math.

Materials Your Class Will Need

Language Art/Poetry Information Sheets and Worksheets and pencils.

Vocabulary

pattern:	an arrangement in a regular or formal manner
rhyme scheme:	the pattern in which words rhyme in a poem, either within the lines or, more often, at the ends of lines; rhyme schemes are labeled with letters
sequence:	a continuous or connected series

Self-Concept Builder

Your students will have an opportunity for creative self-expression through poetry.

Activity

1. See Information Sheets and Worksheets.
2. Discuss with your students the connections between this activity and mathematics.

Occupations Related to This Activity

What occupations might use an activity similar to this one? Have your students complete the career section on their Activity Sheets. After class discussion, they should add these occupations to the list:

WRITER
POET
LYRICIST
LITERARY CRITIC
ENGLISH TEACHER

Discuss the kinds of courses people going into these occupations should take in high school. Have your students add these courses to their Activity Sheets.

Stress that men and women can be equally successful in most careers, if they are qualified.

Suggested Independent Activities

(These suggestions appear on Student Activity Sheets.)

1. Compose a poem of your own, following a rhyme scheme you develop.
2. Set your poem to music.
3. Write new lyrics to a song you already know.

MODULE 2, NUMBER 7 - LANGUAGE ARTS/POETRY

Student Activity Sheet

Your Name _____ Date _____

Overview

In this activity, you will discover that poetry is a mathematical form of self-expression. A poem often follows a set pattern and sequence just as sets of numbers do; if you can find the pattern and resolve the sequence, you can write a poem.

Math Skills You Need to Remember

Analysis of verbal and visual materials to find patterns and sequence.

Things You Will Need

Language Arts/Poetry Information Sheet and Worksheet and a pencil.

Vocabulary

pattern:	an arrangement in a regular or formal manner
rhyme scheme:	the pattern in which words rhyme in a poem, either within the lines or, more often, at the ends of lines; rhyme schemes are labeled with letters
sequence:	a continuous or connected series

When You Finish You Will Be Able To

Recognize patterns and rhyme schemes in the poetry you read and use patterns and rhyme schemes in the poetry you write.

Activity

See Information Sheet and Worksheet.

Occupations Related to This Activity

(You may check the MATHCO Career Wall Charts to get more information about a career in which you are interested.)

OCCUPATIONS	SUBJECTS NEEDED IN HIGH SCHOOL
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Are you interested in any of these careers? Remember, you can be anything you want to be--if you are qualified.

Women and men can do the same jobs with equal success. Can't both women and men enter each of the occupations you've listed above?

Exploring on Your Own

1. Compose a poem of your own, following a rhyme scheme you develop.
2. Set your poem to music.
3. Write new lyrics to a song you already know.

MODULE 2, NUMBER 7 - LANGUAGE ARTS/POETRY

Information Sheet

A rhyme is the repeated final sound of two or more words. The most common kind of rhyme is end rhyme, in which the rhyming words come at the ends of the lines. End rhyming follows a fixed pattern. Here is one common end-rhyme pattern:

Roses are red,	a
Violets are blue,	b
Sugar is sweet,	c
And so are you.	b

Line one ends in the first sound, called "a." Line two ends with a different sound, called "b." Line three ends in yet another sound, called "c." But line four ends in a sound we've already heard in line two, so it is also called "b." Therefore, we have what we call an "a, b, c, b" rhyme pattern or scheme.

The "a, b, c, b" pattern is one of the most common rhyme schemes. Here is another poem that uses this pattern or scheme:

An emerald is as green as grass,	a
A ruby red as blood;	b
A sapphire shines as blue as heaven,	c
A flint lies in the mud.	b
A diamond is a brilliant stone,	a
To catch the world's desire;	b
An opal holds a fiery spark,	c
But a flint holds fire.	b

The words to songs, which are also called "lyrics," are a form of poetry. On the following page are the words to a famous song, along with the rhyme scheme or pattern.

This unit was developed by Linda Kramer.

Oh, give me a home,	a
Where the buffalo roam	a
And the deer and the antelope play.	b
Where seldom is heard,	c
A discouraging word,	c
And the skies are not cloudy all day.	b

Notice that although lines three and six are in different stanzas (or poem paragraphs), they still end in the same sound, so both are named "b." Here is a longer poem with an even more complicated rhyme scheme:

STOPPING BY WOODS ON A SNOWY EVENING

by Robert Frost

Whose woods these are I think I know,	a
His house is in the village though;	a
He will not see me stopping here	b
To watch his woods fill up with snow.	a
My little horse must think it queer	b
To stop without a farmhouse near;	b
Between the woods and frozen lake,	c
The darkest evening of the year.	b
He gives his harness bells a shake	c
To ask if there is some mistake.	c
The only other sound's the sweep	d
Of easy wind and downy flake.	c
The woods are lovely, dark, and deep,	d
But I have promises to keep,	d
And miles to go before I sleep,	d
And miles to go before I sleep.[1]	d

[1]From The Poetry of Robert Frost, edited by Edward Connery Lathem. Copyright 1923; © 1969 by Holt, Rinehart and Winston; copyright 1951 by Robert Frost. Reprinted by permission of Holt, Rinehart and Winston, publishers.

There are many different kinds of poems that have special rhyme schemes. A limerick, for example, always has five lines. The first, second, and fifth lines of a limerick rhyme with one final sound, and the third and fourth lines rhyme with another final sound. A limerick has the following rhyme scheme: "a, a, b, b, a." For example:

There once was a lady named Bright,	a
Whose speed was much faster than light.	a
She set out one day,	b
In a "relative" way,	b
And returned on the previous night.	a

There is plenty of room on this page for you to try to make up a limerick of your own. Reread the sample limerick several times to become familiar with how its words follow a certain rhythm, remember to follow the "a, a, b, b, a" rhyme scheme, and give it a try.

MODULE 2, NUMBER 7 - LANGUAGE ARTS/POETRY

Worksheet

Figure out the rhyme schemes of the following poems:

1. VERSE FROM TRADITIONAL ENGLISH FOLKSONG

Life is a toil and love is a trouble	*a*
Beauty will fade and riches will flee	*b*
Pleasures they dwindle and prices they double	*a*
And nothing is as I would wish it to be.	*b*

2. THE LIZARD
by Theodore Roethke

The time to tickle a lizard	*a*
Is before, or right after, a blizzard.	*a*
Now the place to begin	*b*
Is just under his chin--	*b*
And here's more advice:	*c*
Don't poke more than twice	*c*
At an intimate place like his gizzard.[1]	*a*

See if you can think up an end line for each of the following poems. Make sure they match the rhyme schemes that are given.

3. My favorite flower is the rose,	a
It delights my eyes and my nose.	a
I could watch it by the hour	b
_____	b

[1]"The Lizard," copyright © 1961 by Theodore Roethke, from the book The Collected Poems of Theodore Roethke. Reprinted by permission of Doubleday & Co., Inc.

4. It's hard to wait for the summer sun, a
   When every day is mine to fill b
   With games or whatever I will, b
   _____ a

5. When I am grown, some years from now, a
   A sailor's what I want to be. b
   I'll have my own sailing ship, c
   _____ b

6. I once found a little dog named Spot, a
   Who worried its parents a lot. a
   It whines, barks, and wails, b
   And pulls other dogs' tails, b
   _____ a

The rhyme schemes and first lines of two poems are given. It's up to you to make up the rest of these poems.

7. I wish I were a kangaroo, _____ a
   _____ b
   _____ a
   _____ b

8. When I get older and pick my career, _____ a
   _____ b
   _____ c
   _____ a

MODULE 2, NUMBER 8 - LANGUAGE ARTS/COMPOSITION

Teacher Activity Sheet

Overview

Your students will gain experience in recognizing and using logical sequence, order, and structural relationships in composition.

Math Skills Your Students Will Need

Analysis of verbal and visual materials to find patterns and logical sequential ordering.

Time Allotment

One class period.

Objectives

Your students will discover how to:

1. Identify and use logical paragraph development.
2. Identify and use topic sentences.
3. Write a paragraph in a sequential order.
4. Demonstrate composition skills.
5. Demonstrate analytical skills.
6. Recognize patterns in writing.
7. Become selective and discriminating in choosing necessary information.
8. Translate verbal information into useful math problems.

Materials Your Class Will Need

Language Arts/Composition Worksheets and pencils.

Vocabulary

topic sentence:	the sentence that "sums up" the information in the paragraph
transition words:	words that transmit one idea to the next one, e.g., then, when, now, also, next, however
content:	that which is contained or held within something; what is in a book (or a paragraph)

Self-Concept Builder

Your students will have an opportunity for creative self-expression.

Activity

1. See Worksheets.
2. Discuss with your students the connections between this activity and mathematics.

Occupations Related to This Activity

What occupations might use an activity similar to this one? Have your students complete the career section on their Activity Sheets. After class discussion, they should add these occupations to the list:

JOURNALIST
EDITOR
PLAYWRIGHT
AUTHOR
ENGLISH TEACHER

Discuss the kinds of courses people going into these occupations should take in high school. Have your students add these courses to their Activity Sheets.

Stress that men and women can be equally successful in most careers, if they are qualified.

Suggested Independent Activities

(These suggestions appear on Student Activity Sheets.)

1. Keep a journal of your daily activities.
2. Look through daily newspapers:
   a. Notice how headlines "sum up" the contents of articles.
   b. Are there any letters to the editor that contain unnecessary information?
   c. Circle transition words or phrases.
3. Proofread your homework, taking care to omit unnecessary information and to keep your thoughts in order.
4. Select a problem from your math book and write a story about a situation that the problem would fit.

MODULE 2, NUMBER 8 - LANGUAGE ARTS/COMPOSITION

Student Activity Sheet

Your Name _____ Date _____

Overview

This activity will help you take a "mathematical" approach to your writing. Just as you look for patterns, sequence, and logical order in your math problems, the same thinking can apply to your composition. Be very objective and scientific as you work with the stories in this lesson, and try to see each sentence as an element in a sequence.

Math Skills You Need to Remember

Analysis of verbal and visual materials to find patterns and logical sequential order.

Things You Will Need

Language Arts/Composition Worksheet and a pencil.

Vocabulary

topic sentence:	the sentence that "sums up" the information in the paragraph
transition words:	words that transmit one idea to the next one, e.g., then, when, now, also, next, however
content:	that which is contained or held within something; what is in a book (or a paragraph)

When You Finish You Will Be Able To

Write clear, concise paragraphs that follow a logical sequence and contain no unncessary information.

Activity

See Worksheet.

Occupations Related to This Activity

(You may check the MATHCO Career Wall Charts to get more information about a career in which you are interested.)

OCCUPATIONS	SUBJECTS NEEDED IN HIGH SCHOOL
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Are you interested in any of these careers? Remember, you can be anything you want to be--if you are qualified.

Women and men can do the same jobs with equal success. Can't both women and men enter each of the occupations you've listed above?

Exploring on Your Own

1. Keep a journal of your daily activities.
2. Look through daily newspapers:
   a. Notice how headlines "sum up" the contents of articles.
   b. Are there any letters to the editor that contain unnecessary information?
   c. Circle transition words or phrases.
3. Proofread your homework, taking care to omit unnecessary information and to keep your thoughts in order.
4. Select a problem from your math book and write a story about a situation that the problem would fit.

MODULE 2, NUMBER 8 - LANGUAGE ARTS/COMPOSITION

Worksheet

In each of the following paragraphs, one sentence does not fit the pattern. Cross out the one sentence in each paragraph that does not belong.

1. Judy likes to visit her grandparents on their farm. ~~Judy's grandmother was born in a little town in Kansas.~~ She enjoys helping her grandparents do the chores. Judy especially enjoys playing with all the animals. After a hard day of work and play, Judy likes to go to bed early and dream about what the next day on the farm will be like.

2. Ted had seventy cents with which to purchase candy. He spent fifty cents for two large candy bars. ~~Ted had three cavities last year.~~ He spent fifteen cents on bubble gum. How much money will Ted have left over to buy candy tomorrow?

In each of the following paragraphs, which sentence is the topic sentence? Underline the one sentence in each paragraph that best sums up the paragraph.

3. What excitement! When the alarm went off, everyone just sat still and looked around. Nobody knew for sure what was happening. Finally, the teachers grabbed their grade books and began giving hasty instructions. Somehow, we all made it outside in less than two minutes. It was the best surprise fire drill our school has ever had.

4. Festerboyle is the most obnoxious dog I've ever seen. He runs around our neighborhood all day and all night barking at and chasing anything that moves. He always has dog food smeared all over his face and mud splattered all over his legs and feet. What's more, he LOVES jumping up on people and getting stale dog food and mud on them, too. His fur is almost as wet and greasy as his nose. Yesterday he jumped into the open window of our car and apparently tried to hide a dead rat under the front seat!

Number each of the following groups of sentences in a logical sequence. Be sure to look for transition words that will help you. The sentence that tells what happened first should be numbered 1, the sentence that tells what happened second should be numbered 2, and so on.

5. ___5___ Finally, airline attendants get to meet people and make friends all over the world.

___3___ They have to be prepared to handle many kinds of emergencies.

___1___ Airline attendants have very interesting jobs.

___2___ The many interesting aspects of a career as an airline attendant make it seem very glamorous.

___4___ They also get to travel to many exciting places.

6. ___5___ Watching "Star Trek" on television helps me make the adjustment to being home again.

___2___ Once I'm up, it's only a minor torture having to get ready to go to school.

___7___ Getting to bed on time is never a problem for me if my little sister is already asleep.

___3___ If I make it to school on time, my day is bound to go well for me.

___1___ Getting out of bed in the morning is the hardest part of my day.

___6___ Homework after dinner is easy for me to finish if my mom or dad helps me a little.

___8___ Before I know it, it's time for the routine to begin all over again.

___4___ After I suffer through a peanut butter and jelly sandwich at lunch, the afternoon is a breeze.

Number the following sentences in a logical sequence. Underline the topic sentence. Cross out the sentence that does not fit the pattern.

7. 6 But perhaps Buster's greatest accomplishment is his bone cemetery in our backyard.

5 He also chases invading cars off "his" street.

~~Our cat, Sunshine, is a Siamese.~~

1 If they gave an award for the "Dog of the Year," our dog, Buster, would win.

2 Courage, loyalty, and respect for the dead are just a few of the honorable attributes of our Buster.

4 Not only is Buster fearless when defending our home and street, but he is the acknowledged champion barker of the neighborhood.

3 Buster fearlessly defends our home against vicious neighborhood animals.

Select one of the topic sentences below, and write a paragraph based on it. Your paragraph should have at least five sentences, arranged in a logical order.

8. A. My locker may look junky, but I always know exactly what's in it.

B. Making a protective cover for my math book was not as easy as I thought it would be.

C. Birthdays are always special at our house.

D. This past summer was one of the best summers of my life.

Your paragraph:

MODULE 2, NUMBER 9 - FRACTIONS/MATH

Teacher Activity Sheet

Overview

Your students will sharpen their skills in working with fractions. The concept of a whole being made up of component parts will be reinforced.

Math Skills Your Students Will Need

Addition, subtraction, multiplication, and division of fractions.

Time Allotment

Two class periods.

Objectives

Your students will:

1. Be introduced to or sharpen their skills in working with fractions.
2. Reinforce concepts about the component parts of a whole.

Materials Your Class Will Need

Fractions/Math Worksheets and pencils.

Vocabulary

fraction:	a component part of a whole
improper fraction:	a fraction whose numerator (the part of the fraction above the line) is equal to or larger than the denominator (the part of the fraction below the line)
mixed number:	a number made up of a whole number and a fraction
reduce:	to simplify; to break down into parts

Self-Concept Builder

Your students will gain confidence as they progress from the easy exercises to the more difficult ones.

Activity

1. See Worksheets. You will select worksheet items that reflect each student's ability, using items that are "too easy" as well as the more challenging ones.
2. Discuss with your students the connections between this activity and mathematics.

Occupations Related to This Activity

What occupations might use an activity similar to this one? Have your students complete the career section on their Activity Sheets. After class discussion, they should add these occupations to the list:

MATHEMATICIAN	ENGINEER	RESTAURANT OWNER/ MANAGER
ARCHITECT	DATA PROCESSOR	
TOY DESIGNER	MATH TEACHER	CHEF

Discuss the kinds of courses people going into these occupations should take in high school. Have your students add these courses to their Activity Sheets.

Stress that men and women can be equally successful in most careers, if they are qualified.

Suggested Independent Activities

(These suggestions appear on Student Activity Sheets.)

Look through your textbook for other opportunities to work with fractions.

MODULE 2, NUMBER 9 - FRACTIONS/MATH

Student Activity Sheet

Your Name _____ Date _____

Overview

In this activity, you will sharpen your skills in working with and in solving problems that involve fractions.

Math Skills You Need to Remember

Addition, subtraction, multiplication, and division of fractions.

Things You Will Need

Fractions/Math Worksheet and a pencil.

Vocabulary

fraction:	a component part of a whole
improper fraction:	a fraction whose numerator (the part of the fraction above the line) is equal to or larger than the denominator (the part of the fraction below the line)
mixed number:	a number made up of a whole number and a fraction
reduce:	to simplify; to break down into smaller parts

When You Finish You Will Be ... To

Work problems that involve the use of fractions.

Activity

1. Fill out the worksheet items assigned by your teacher.
2. Be sure to ask for help if you need it.

Occupations Related to This Activity

(You may check the MATHCO Career Wall Charts to get more information about a career in which you are interested.)

OCCUPATIONS	SUBJECTS NEEDED IN HIGH SCHOOL
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Are you interested in any of these careers? Remember, you can be anything you want to be--if you are qualified.

Women and men can do the same jobs with equal success. Can't both women and men enter each of the occupations you've listed above?

Exploring on Your Own

Look through your textbook for other opportunities to work with fractions.

MODULE 2, NUMBER 9 - FRACTIONS/MATH

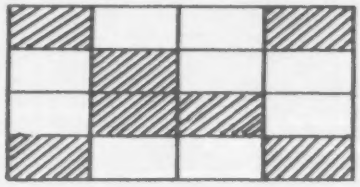
Worksheet

WRITING FRACTIONS AND MIXED NUMBERS

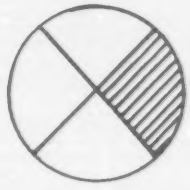
A. Write a fraction for the shaded part of each figure.

Example: $\frac{1}{3}$

1. $\frac{3}{5}$

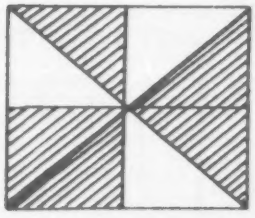
2.  $\frac{7}{16}$

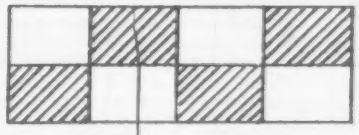
3. $\frac{2}{5}$

4.  $\frac{1}{4}$

5. $\frac{3}{8}$

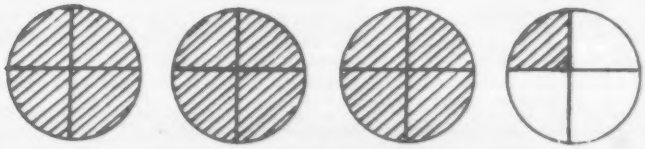
6. $\frac{5}{14}$

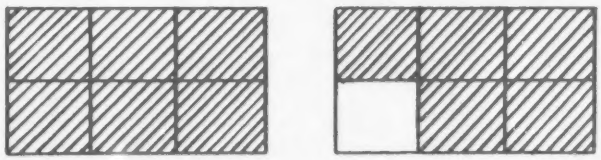
7.  $\frac{5}{8}$

8.  $\frac{4}{8}$ or $\frac{1}{2}$

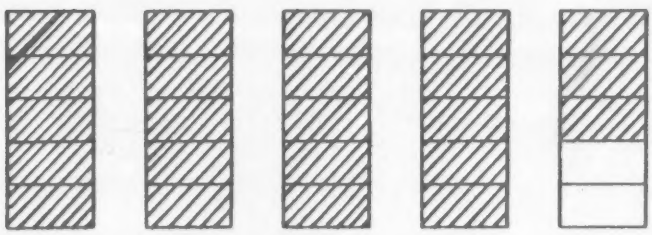
B. Write a mixed number for the shaded parts of these figures.

Example: $2\frac{2}{3}$

1.  $3\frac{1}{4}$

2. 

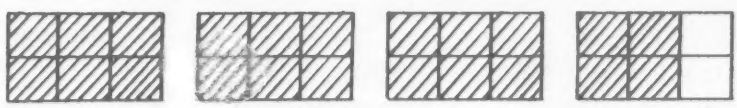
$1\frac{5}{6}$

3. 

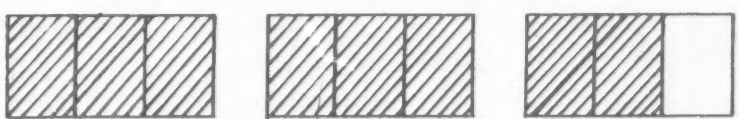
$4\frac{3}{5}$

4.

$5\frac{1}{2}$

5. 

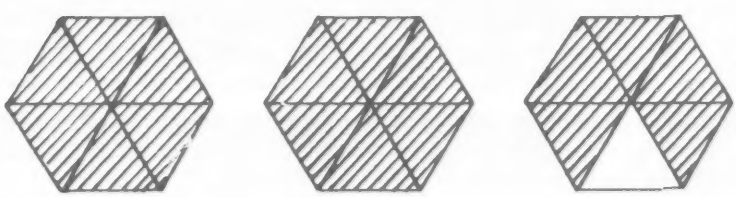
$3\frac{4}{6}$ or $3\frac{2}{3}$

6. 

$2\frac{2}{3}$

7.

$4\frac{3}{8}$

8. 

$2\frac{5}{6}$

9.

$6\frac{1}{2}$

ADDING FRACTIONS

C. Rewrite the figures as fractions or mixed numbers; then add:

Example: ($\frac{1}{3}$) ($\frac{1}{3}$)

$= \frac{2}{3}$

1. ($1\frac{1}{4}$) ($\frac{2}{4}$)

$= 1\frac{3}{4}$

2. ($2\frac{1}{4}$) ($1\frac{2}{4}$)

$= 3\frac{3}{4}$

3. ($1\frac{2}{5}$) ($\frac{1}{5}$)

$= 1\frac{3}{5}$

4. ($\frac{2}{6}$) ($2\frac{3}{6}$)

$= 2\frac{5}{6}$

5. ($2\frac{1}{8}$) ($1\frac{1}{2}$)

$= 4$

D. Add these fractions and mixed numbers.

1. $\frac{3}{4} + \frac{1}{4} = \frac{4}{4} = 1$

2. $\frac{2}{5} + \frac{1}{5} = \frac{3}{5}$

3. $1 + \frac{1}{2} = 1\frac{1}{2}$

4. $3\frac{3}{5} + 2\frac{1}{5} = 5\frac{4}{5}$

5. $1\frac{1}{2} + 1\frac{1}{2} = 3$

6. $7\frac{1}{8} + 1\frac{6}{8} = 8\frac{7}{8}$

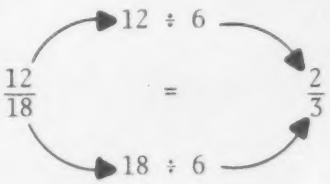
7. $1\frac{2}{7} + 6\frac{3}{7} = 7\frac{5}{7}$

8. $\frac{5}{16} + 3\frac{2}{16} = 3\frac{7}{16}$

REDUCING AND RENAMING FRACTIONS

E. Rename each of the following fractions by reducing the fraction to its lowest terms.

Example:



1. $\frac{8}{12} = \frac{2}{3}$ 2. $\frac{6}{24} = \frac{1}{4}$ 3. $\frac{10}{20} = \frac{1}{2}$

4. $\frac{9}{27} = \frac{1}{3}$ 5. $\frac{12}{16} = \frac{3}{4}$ 6. $\frac{4}{32} = \frac{1}{8}$

7. $\frac{33}{55} = \frac{3}{5}$ 8. $\frac{21}{35} = \frac{3}{5}$ 9. $\frac{30}{36} = \frac{5}{6}$

10. $\frac{24}{40} = \frac{3}{5}$ 11. $\frac{15}{80} = \frac{3}{16}$ 12. $\frac{75}{100} = \frac{3}{4}$

RENAMING AND REWRITING IMPROPER FRACTIONS

F. Write each fraction as a mixed or whole number. Remember, if the remainder is not zero, it should be written as a fraction.

Example: $\frac{63}{5} = 63 \div 5 = 12\frac{3}{5}$

1. $\frac{109}{5} = 21\frac{4}{5}$ 2. $\frac{23}{4} = 5\frac{3}{4}$ 3. $\frac{38}{6} = 6\frac{2}{6} = 6\frac{1}{3}$

4. $\frac{35}{7} = 5$ 5. $\frac{73}{9} = 8\frac{1}{9}$ 6. $\frac{52}{8} = 6\frac{4}{8} = 6\frac{1}{2}$

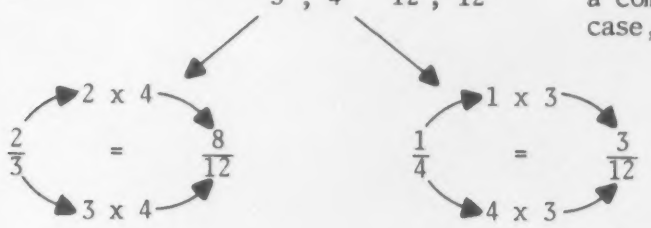
7. $\frac{48}{2} = 24$ 8. $\frac{59}{6} = 9\frac{5}{6}$ 9. $\frac{44}{3} = 14\frac{2}{3}$

10. $\frac{130}{10} = 13$

FINDING COMMON DENOMINATORS

G. Rewrite the following fractions with a common denominator.

Example: $\frac{2}{3}, \frac{1}{4} = \frac{8}{12}, \frac{3}{12}$ (The common denominator is a common multiple. In this case, it is 12.)



1. $\frac{3}{4}, \frac{1}{3} = \frac{9}{12}, \frac{4}{12}$

2. $\frac{1}{3}, \frac{5}{6} = \frac{2}{6}, \frac{5}{6}$

3. $\frac{5}{8}, \frac{1}{4} = \frac{5}{8}, \frac{2}{8}$

4. $\frac{1}{6}, \frac{7}{12} = \frac{2}{12}, \frac{7}{12}$

5. $\frac{1}{2}, \frac{1}{3} = \frac{3}{6}, \frac{2}{6}$

6. $\frac{4}{5}, \frac{1}{2} = \frac{8}{10}, \frac{5}{10}$

7. $\frac{3}{4}, \frac{2}{5} = \frac{15}{20}, \frac{8}{20}$

8. $\frac{7}{8}, \frac{1}{3} = \frac{21}{24}, \frac{8}{24}$

9. $\frac{4}{5}, \frac{1}{3} = \frac{12}{15}, \frac{5}{15}$

10. $\frac{3}{4}, \frac{1}{6} = \frac{9}{12}, \frac{2}{12}$

ADDING FRACTIONS WITH DIFFERENT DENOMINATORS

H. Add the following fractions. You will need to find the common denominators and rewrite your answers as mixed numbers.

Example:
$$\frac{3}{4} = \frac{6}{8}$$
$$+\ \frac{3}{8} = \frac{3}{8}$$
$$\frac{9}{8} = 1\frac{1}{8}$$

1. $\frac{5}{6} = \frac{5}{6}$
$+\ \frac{1}{3} = \frac{2}{6}$
$\frac{7}{6} = 1\frac{1}{6}$

2. $\frac{1}{2} = \frac{2}{4}$
$+\ \frac{3}{4} = \frac{3}{4}$
$\frac{5}{4} = 1\frac{1}{4}$

3. $\frac{1}{2} = \frac{3}{6}$
$+\ \frac{2}{3} = \frac{4}{6}$
$\frac{7}{6} = 1\frac{1}{6}$

4. $\frac{7}{9} = \frac{7}{9}$
$+\ \frac{1}{3} = \frac{3}{9}$
$\frac{10}{9} = 1\frac{1}{9}$

5. $\frac{7}{8} = \frac{14}{16}$
$+\ \frac{5}{16} = \frac{5}{16}$
$\frac{19}{16} = 1\frac{3}{16}$

6. $\frac{9}{14} = \frac{9}{14}$
$+\ \frac{5}{7} = \frac{10}{14}$
$\frac{19}{14} = 1\frac{5}{14}$

7. $\frac{1}{9} = \frac{2}{18}$
$+\ \frac{5}{6} = \frac{15}{18}$
$\frac{17}{18}$

8. $\frac{3}{4} = \frac{9}{12}$
$+\ \frac{7}{12} = \frac{7}{12}$
$\frac{16}{12} = 1\frac{4}{12}$
or $1\frac{1}{3}$

9. $\frac{3}{10} = \frac{3}{10}$
$+\ \frac{4}{5} = \frac{8}{10}$
$\frac{11}{10} = 1\frac{1}{10}$

10. $\frac{3}{4} = \frac{15}{20}$
$+\ \frac{5}{10} = \frac{10}{20}$
$\frac{25}{20} = 1\frac{5}{20}$ or $1\frac{1}{4}$

MODULE 2, NUMBER 10 - FRACTIONS/LANGUAGE ARTS

Teacher Activity Sheet

Overview

This lesson approaches etymology and vocabulary building by use of math concepts dealing with fractions.

Math Skills Your Students Will Need

An understanding of fractions as component parts of a whole.

Time Allotment

Two class periods.

Objectives

Your students will:

1. Apply math skills and concepts in deciphering the meanings of words.
2. Identify prefixes, suffixes, and root words as component parts of words.
3. Discover the science of etymology.
4. Increase their vocabulary by learning the meanings of common prefixes and suffixes.

Materials Your Class Will Need

Fractions/Language Arts Worksheets, pencils, and dictionaries.

Vocabulary

etymology:	the study of the history of words--where they came from, how they're put together, and how their meanings have changed
prefix:	a small part of a word that is added to the beginning of a word to change its meaning
suffix:	an addition to the end of a word that changes its meaning
root:	the basic word to which prefixes and/or suffixes may be added
	Example: UN - LIKE - LY (prefix) (root) (suffix)

Self-Concept Builder

Your students can use their math skills to increase their vocabularies and use their language arts skills to enhance their success in math.

Activity

1. Have students fill out Worksheets either individually or with partners, using dictionaries.
2. Discuss with your students the connections between this activity and mathematics.

Occupations Related to This Activity

What occupations might use an activity similar to this one? Have your students complete the career section on their Activity Sheets. After class discussion, they should add these occupations to the list:

ETYMOLOGIST	SOCIOLOGIST
WRITER	ANTHROPOLOGIST
RESEARCHER	ENGLISH TEACHER

Discuss the kinds of courses people going into these occupations should take in high school. Have your students add these courses to their Activity Sheets.

Stress that women and men can be equally successful at most careers, if they are qualified.

Suggested Independent Activities

(These suggestions appear on Student Activity Sheets.)

1. Find the origins of words of your own choosing.
2. Develop new words to which you can add traditional prefixes and suffixes.
3. Research the etymology of your name.

MODULE 2, NUMBER 10 - FRACTIONS/LANGUAGE ARTS

Student Activity Sheet

Your Name _____ Date _____

Overview

This activity is designed to help you see words as being made up of smaller parts--or fractions--that, when added together, become meaningful expressions.

Math Skills You Need to Remember

How to recognize and use fractions.

Things You Will Need

Fractions/Language Arts Worksheet, a pencil, and a dictionary.

Vocabulary

etymology:	the study of the history of words--where they came from, how they're put together, and how their meanings have changed
prefix:	a small part of a word that is added to the beginning of a word to change its meaning
suffix:	an addition to the end of a word that changes its meaning
root word:	the basic word to which prefixes and/or suffixes may be added

Example: UN - LIKE - LY
(prefix) (root) (suffix)

When You Finish You Will Be Able To

Reduce new, big words to their component fractions to help you figure out their meanings.

Activity

Use a dictionary to help you complete the Worksheet. Your teacher may let you choose a partner to work with.

Occupations Related to This Activity

(You may check the MATHCO Career Wall Charts to get more information about a career in which you are interested.)

OCCUPATIONS	SUBJECTS NEEDED IN HIGH SCHOOL

Are you interested in any of these careers? Remember, you can be anything you want to be--if you are qualified.

Women and men can do the same jobs with equal success. Can't both women and men enter each of the occupations you've listed above?

Exploring on Your Own

1. Find the origins of words of your own choosing.
2. Develop new words to which you can add traditional prefixes and suffixes.
3. Research the etymology of your name.

MODULE 2, NUMBER 10 - FRACTIONS/LANGUAGE ARTS

Worksheet

Many of the words we use every day are like mixed numbers, in a way. They are made up of more than one word--like sales person--or they have a "fraction" added to them--like wonder ful.

When you learn a new word, for example, LEGAL (which means within the law), you have actually learned several new words:

ILLEGAL LEGALLY ILLEGALLY LEGALITY LEGATION

If you know the meaning of LEGAL, these other words will now have some meaning for you. LEGAL can be thought of as a root word, or common denominator, for all five of these other words.

Here are some common prefixes and suffixes and their meanings. On the lines below them, you may add any others that you happen to know.

PREFIXES		SUFFIXES	
re-	again	-ize	to cause to be
e-, ex-	out	-ly	in such a manner
in-, un-	not	-ist	one who does
con-	with	-ism	theory of, result of
dis-	shows the reverse or opposite of	-less	without
		-ness	condition of being
non-	not (less intense than in- or un-)	-ing	progression of
		-ed	past tense
pre-	come before	-ment	result of
extra-	outside of	-er, -or	one who does
inter-	between, with	-able	capable of being
micro-	very small	-ion	act or state of
tele-	at a distance	-en	to cause, to be made from
il-	not, bad	-ful	having
en-	to cause, to make	-an, -ian, -ean	of or belonging to, characteristic of
mis-	badly, wrongly, opposite or lack of		
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

See how many new words you can make by adding fractions to root words.

Example: micro + organ + ism = microorganism

PREFIXES	ROOTS	SUFFIXES
re-	scope	-ly
e-, ex-	organ	-ist
in-, un-	credit	-ism
con-	strict	-less
dis-	tort	-ness
pre-	flex	-ed
extra-	ordinary	-ment
inter-	sterile	-er, -or
micro-	view	-able
tele-	act	-ion

retort, review, react	*telescope*	*organism*
creditable	*distortion*	*action*
constrict	*interaction*	*viewer*
strictness, strictly	*extraordinary*	*interview*
organist	*actor, creditor*	*preview*

Discover the meanings of these new words. Be sure to use your dictionary, because spelling is important.

Reduce the following words to their "lowest terms."

Example:	PREFIX(ES)	ROOT	SUFFIX(ES)
subtraction	sub-	tract	-ion

	PREFIX(ES)		ROOT		SUFFIX(ES)
1. unnaturally	*un-*	+	*natural*	+	*-ly*
2. dissimilarity	*dis-*	+	*similar*	+	*-ity*

		PREFIX(ES)		ROOT		SUFFIX(ES)
3.	disorganization	*dis-*	+	*organ*	+	*-ize -a -tion*
4.	interrelated	*inter-*	+	*relate*	+	*-(e)d*
5.	interaction	*inter-*	+	*act*	+	*-ion*
6.	requiring			*requir(e)*	+	*-ing*
7.	unremorsefully	*un-*	+	*remorse*	+	*-ful -ly*
8.	anticommunist	*anti-*	+	*commun(e)*	+	*-ist*
9.	undemocratically	*un-*	+	*democrat*	+	*-ic -al -ly*
10.	immaturity	*im-*	+	*matur(e)*	+	*-ity*
11.	misjudgment	*mis-*	+	*judg(e)*	+	*-ment*
12.	unserviceable	*un-*	+	*service*	+	*-able*
13.	illegibly	*il-*	+	*legib(le)*	+	*-ly*

Use your dictionary to look up the meanings of any new prefixes or suffixes.

Using the prefixes and suffixes found on page one of this Worksheet, create new words that have the same meanings as the phrases given below. Remember to use your dictionary to check your spelling.

1. Having:
   a. beauty — *beautiful*
   b. mercy — *merciful*
   c. mirth — *mirthful*
   d. wonder — *wonderful*

2. Not:
   a. moral — *immoral*
   b. interested — *uninterested*
   c. logical — *illogical*
   d. happy — *unhappy*
   e. capable — *incapable*

3. Someone who follows the teachings of:
   a. Buddha — *Buddhist*
   b. Darwin — *Darwinist*
   c. Christ — *Christian*

4. Without:
   a. pity — *pitiless*
   b. money — *moneyless*
   c. humor — *humorless*

5. Coming from:
   a. Europe — *European*
   b. America — *American*
   c. Africa — *African*
   d. Asia — *Asian*
   e. (Your state) — *(E.g., Oklahoman)*

Underline the root word, or "common denominator," in each of the following sets of words. Then define each word, using your dictionary and page one of this Worksheet.

Example:
- pre<u>view</u> — to see before
- re<u>view</u> — to see again
- <u>view</u>er — one who sees

1. <u>shape</u>less — *without shape*
   mis<u>shape</u>n — *shaped badly*
   <u>shape</u>ly — *having a pleasant shape*

2. <u>un</u>wedded — *has not been wed*
   <u>wed</u>ding — *the process of being wed*
   re<u>wed</u> — *to wed again*

3. disagree — *not to agree*

   agreeable — *capable of agreeing*

   agreement — *the result of agreeing*

   agreed — *past tense of agree*

4. lively — *being full of life*

   relive — *to live again*

   enliven — *to make live(ly)*

   living — *in the course of life*

5. joyful — *having joy*

   enjoy — *to cause joy*

   enjoyable — *to be capable of causing joy*

   joyless — *without joy*

Now that you have completed this MATHCO activity, use the lines below to explain what you think this activity has to do with mathematics or arithmetic.

The main idea is that words are related to concepts of fractions.

MODULE 2, NUMBER 11 - GRAPHS AND FRACTIONS/MUSIC

Teacher Activity Sheet

Overview

Your students will gain experience in using and interpreting graphs and fractions while being introduced to the symbols musicians use for graphing time.

Math Skills Your Students Will Need

Substitution, understanding of fractions and the relationship of parts to a whole, ordering of operations, and reading a graph. They will be challenged as they listen to and follow directions.

Time Allotment

Two class periods.

Objectives

Your students will:

1. Make and interpret graphs.
2. Recognize fractions as they occur in music.
3. Recognize and use musical symbols of notation values.
4. Translate a symbolic sentence into a graph.
5. Translate a graph into symbols.
6. Translate sounds into a graph.
7. Translate sounds into symbols.
8. Translate symbols into sounds.
9. Translate a graph into sounds.
10. Explore basic musical notation.

Materials Your Class Will Need

Graphs and Fractions/Music Worksheets and pencils.

Vocabulary

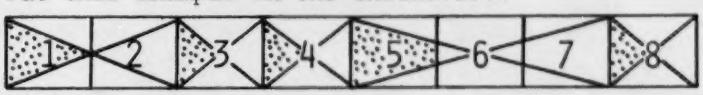
attack:	when a sound begins
duration:	how long a sound lasts
graph:	a picture or diagram of changes
notes:	musical symbols that represent lengths of time
beat/pulse:	regular divisions of time
rhythm:	a regulated pattern formed by long and/or short notes
legend:	a key; information given to help you use a map or a graph

Self-Concept Builder

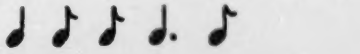
Students will use their skills of listening and observation to explore the relationship of math and music. This activity may give some of your band and choir students a real chance to shine in math class.

Activity

1. Take your students through Parts I-IV of their Graphs and Fractions/ Music Worksheets in the following manner:
   a. Carefully go over Part I with your students, making sure they understand that they are working with rhythms of eight beats (or pulses), that an "X" represents the duration of a note, and that a box shaded on its left-hand side indicates where the note begins (the note's attack). Clarify vocabulary as you go along. Perhaps some additional examples on the chalkboard would help make sure that your students understand the last example in Part I.
   b. Look at the legend on the top of page two of the Worksheet. Explain that each of the symbols represents a note with a particular duration. Bring in the tie to fractions by having them discover and visualize why is an eighth note, why is a half note, etc. Here again, putting these on the chalkboard might help.
   c. Put this example on the chalkboard:



Have your students figure out together which musical notes represent what is shown on this graph.

Answer: 

When you are sure they understand, have them complete Part II, and go over all the answers with them.

d. Now put these musical notes on the board:

Have several volunteers come to the board and fill in a blank graph correctly.

Answer:

Now have your students complete Part III. When all have finished, go over their answers with them.

e. In Part IV, you will set a beat (counting out loud: 1, 2, 3, 4, 5, 6, 7, 8; 1, 2, 3, 4, 5, 6, ready, begin...) and clap on the following numbers:

(1) 1, 2, 5, 7

(2) 1, 3, 4, 5

(3) 1, 4, 5

(4) 1, 3, 5, 7, 8

Your students should listen carefully and put a small dot in each box at the point at which they hear a clap. (You may need to repeat each rhythm more than once so they can double-check themselves.) After all of the rhythms have been given to them, they should complete the graphs on their Worksheets (the dots tell them where each note begins), and also write out the appropriate musical notes for each rhythm. Go over all of the answers with your class. You might want to have them put answers on the chalkboard so that all can see.

2. Parts V, VI, and VII can be completed by having your students work in pairs. Make sure that they notice that each part has a different legend.

3. Discuss with your students the connections between this activity and mathematics.

List of Occupations Related to This Activity

What occupations might use an activity similar to this? Have your students complete the career section on their Activity Sheets. After class discussion, they should add these occupations to the list:

MUSICIAN	COMPOSER	CHOREOGRAPHER
CONDUCTOR	ANALYST	DANCER

Discuss the kinds of courses people going into these occupations should take in high school. Have your students add these courses to their Activity Sheets.

Stress that women and men can be equally successful in most careers, if they are qualified.

Suggested Independent Activities

(These suggestions appear on Student Activity Sheets.)

1. Graph the rhythm of a phrase from a popular or famous song.
2. Graph the rhythms of a song that you compose.
3. Challenge your friends to a game in which you make up and graph each others' rhythms.

MODULE 2, NUMBER 11 - GRAPHS AND FRACTIONS/MUSIC

Student Activity Sheet

Your Name _____ Date _____

Overview

This activity will help you explore different ways of recording rhythms on paper. You will use math skills in making a graph of sounds that you hear, and you will see how musicians use certain symbols to indicate time.

Math Skills You Need to Remember

Fractions, using graphs, substitution, ordering of operations, and listening to and following directions.

Things You Will Need

Graphs and Fractions/Music Worksheet and a pencil.

Vocabulary

attack:	when a sound begins
duration:	how long a sound lasts
graph:	a picture or diagram of changes
notes:	musical symbols that represent lengths of time
beat/pulse:	regular divisions of time
rhythm:	a regulated pattern, formed by long and/or short notes
legend:	a key; information given to help you use a map or a graph

When You Finish You Will Be Able To

Make a graph of sounds that you hear, and understand one of the ways in which musicians write down their sounds.

Activity

1. Your teacher will explain the Graphs and Fractions/Music Worksheet to you.
2. Parts I-IV will be done together as a class. Parts V-VII you will complete with a partner.

Occupations Related to This Activity

(You may check the MATHCO Career Wall Charts to get more information about a career in which you are interested.)

OCCUPATIONS	SUBJECTS NEEDED IN HIGH SCHOOL

Are you interested in any of these careers? Remember, you can be anything you want to be--if you are qualified.

Women and men can do the same jobs with equal success. Can't both women and men enter each of the occupations you've listed above?

Exploring on Your Own

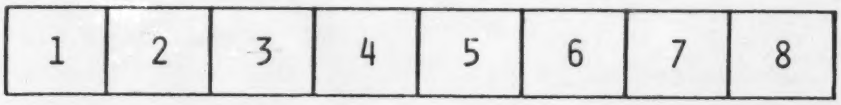
1. Graph the rhythm of a phrase from a popular or famous song.
2. Graph the rhythms of a song that you compose.
3. Challenge your friends to a game in which you make up and graph each others' rhythms.

MODULE 2, NUMBER 11 - GRAPHS AND FRACTIONS/MUSIC

Worksheet

PART I: SOME EXPLANATIONS

You will be working with a graph that looks like this:

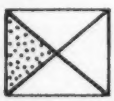


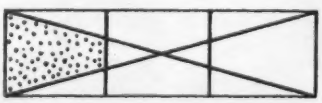
This graph represents eight beats (or pulses) of music. As you work with this graph on the following pages, you will see that each note is represented by an "X." The duration of the note is indicated by the number of boxes that the "X" covers. The "X" is drawn to fit the corners of the number of boxes or beats needed. For example:

- Note of short duration

- Note of longer duration

Another thing that you will need to know is that the first box at which a note is sounded is shaded (on the left-hand side) to indicate that note's attack (when the sound begins). To use the same example:

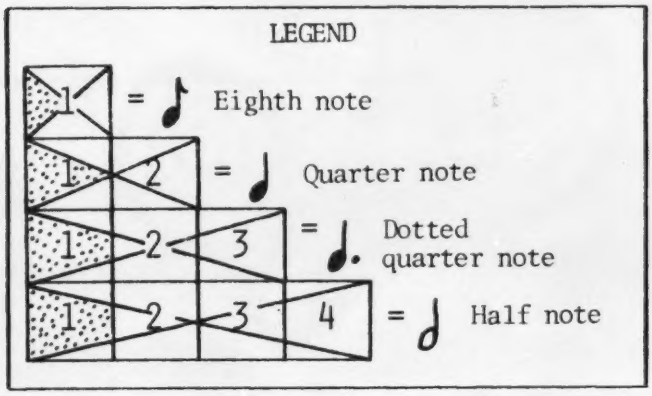
 - This note lasts one beat

 - This note lasts three beats; the shading shows where the sound begins

Look at the example below, which reviews what you have learned so far:

THIS GRAPH REPRESENTS EIGHT BEATS (OR PULSES) OF MUSIC AND FOUR NOTES. THE FIRST NOTE LASTS ONE BEAT (ONE BOX), THE SECOND NOTE LASTS TWO BEATS (TWO BOXES), THE THIRD NOTE LASTS TWO BEATS (TWO BOXES), AND THE FOURTH NOTE LASTS THREE BEATS (THREE BOXES). TRY CLAPPING OUT THIS RHYTHM AS YOU COUNT SOFTLY OUT LOUD:

clap	clap		clap		clap		
1	2	3	4	5	6	7	8



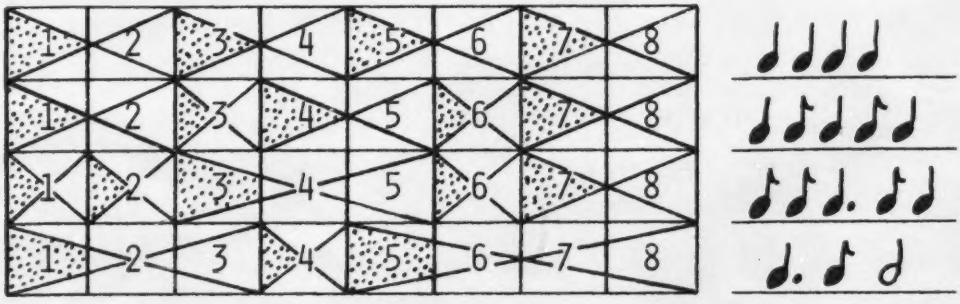
This legend gives you the information you will need to complete this page.

In Part II, the graph is done for you. In the space provided, write the correct musical notes that represent the graph.

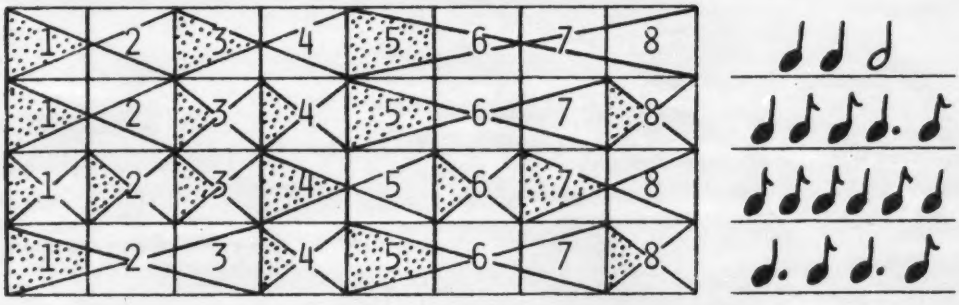
In Part III, the notes are given to you. Fill in the graph correctly.

In Part IV, your teacher will clap out four rhythms for you. Each time you hear a clap, put a little dot in the box that has that number in it. After you have heard all four rhythms, fill in the graphs and the musical notes that these rhythms represent.

PART II



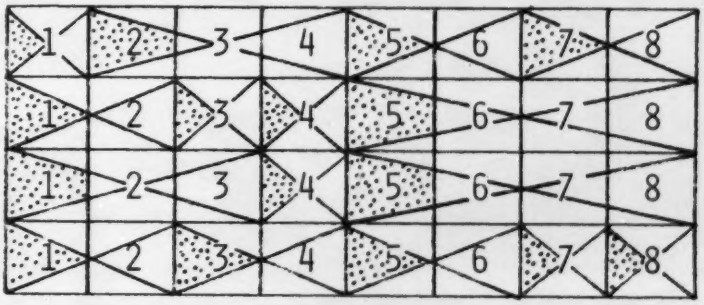
PART III



111

PART IV

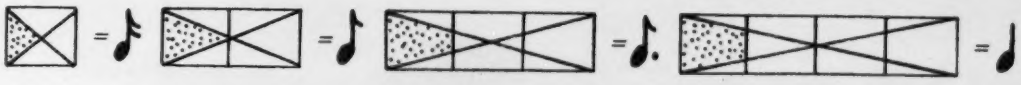
(1)
(2)
(3)
(4)

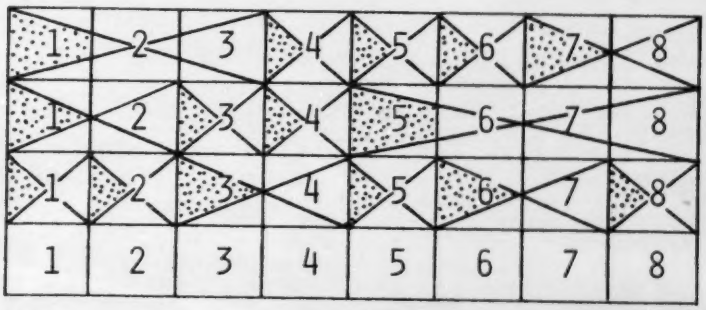


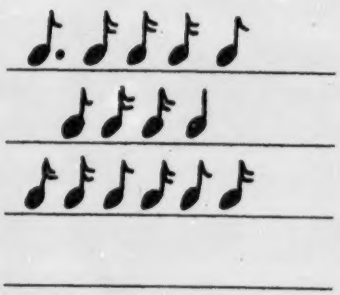
Choose a partner and complete the following sections together. Notice that each part has a different legend. The last graph of each part is blank. You and your partner should decide upon a rhythm of your choice, graph it, and write the notes that the rhythm represents. Notice the double-flagged note ( ) introduced here. It is called a sixteenth note and is twice as fast as an eighth note.

PART V

Legend:

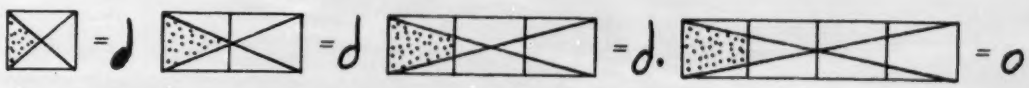


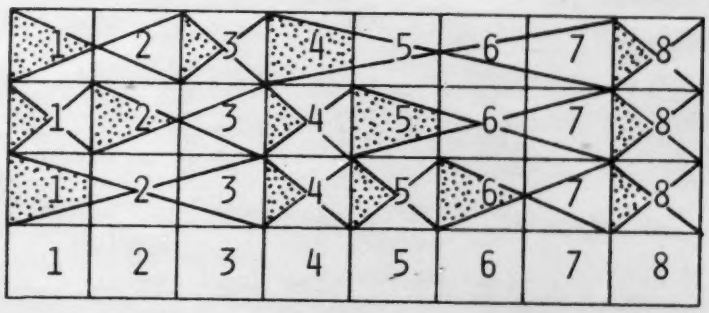


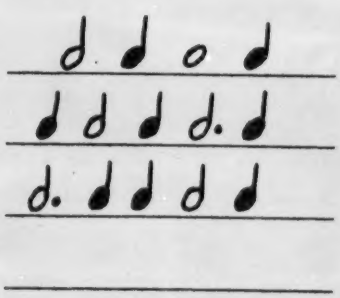


PART VI

Legend:

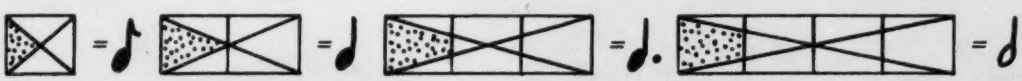


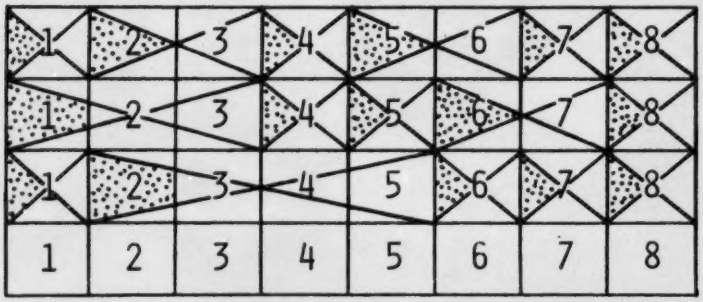


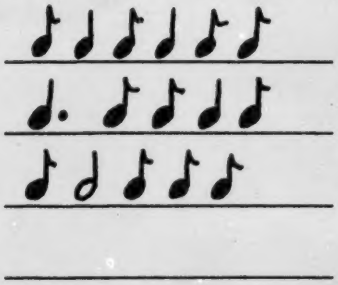


PART VII

Legend:







MODULE 2, NUMBER 12 - GRAPHS AND FRACTIONS/ART AND DRAMA

Teacher Activity Sheet

Overview

Your students will explore the use of the square as a component of infinite visual statements as well as a measuring aid in enlarging or reducing drawings. They will also sharpen their measuring and composition skills as they become acquainted with a "blueprint" of a theatrical flat.

Math Skills Your Students Will Need

Measuring linear distances and addition and subtraction of fractions.

Time Allotment

Two class periods.

Objectives

Your students will:

1. Use a square as a component of visual statements.
2. Enlarge or reduce a drawing through use of squares.
3. Enlarge or reduce a drawing through use of measurements and mathematical operations.
4. Use different values in a visual statement.
5. Identify the uses and components of a "flat."

Materials Your Class Will Need

Graphs and Fractions/Art and Drama Worksheets, rulers, and pencils.

Vocabulary*

value:	the lightness or darkness of an area
flat:	a segment of stage scenery made with lumber and muslin
motif:	a repeated element in a design

*These terms are defined in the area of art and drama. Your students may wish to discuss how the definitions vary in different settings or disciplines.

Self-Concept Builder

Your students will have the opportunity to make a personal visual statement.

Activity

1. See Worksheets.
2. Discuss with your students the connections between this activity and mathematics.

Occupations Related to This Activity

What occupations might use an activity similar to this one? Have your students complete the career section on their Activity Sheets. After class discussion, they should add these occupations to the list:

ARTIST	ENGINEER
DRAFTING ARTIST	CARPENTER
ARCHITECT	THEATRICAL SCENE DESIGNER

Discuss the kinds of courses people going into these occupations should take in high school. Have your students add these courses to their Activity Sheets.

Stress that men and women can be equally successful at most careers, if they are qualified.

Suggested Independent Activities

(These suggestions appear on Student Activity Sheets.)

1. Make drawings based on other geometric motifs (circles, triangles, etc.).
2. Visit a local theatre to see how flats are made and used.

MODULE 2, NUMBER 12 - GRAPHS AND FRACTIONS/ART AND DRAMA

Student Activity Sheet

Your Name _____ Date _____

Overview

This activity will help you see how artists and theatrical scene designers can use simple components to make their elaborate visual designs.

Math Skills You Need to Remember

How to use a ruler and how to add and subtract fractions.

Things You Will Need

Graphs and Fractions/Art and Drama Worksheet (on graph paper), a ruler, and a pencil.

Vocabulary*

value:	the lightness or darkness of an area
flat:	a segment of stage scenery made with lumber and muslin
motif:	a repeated element in a design

When You Finish You Will Be Able To

1. Make a design or a drawing using only squares and values.
2. Enlarge or reduce a drawing by using graph paper (squares) or by using measurements and mathematical skills.

Activity

See Worksheet.

*Do you know other definitions for these words?

Occupations Related to This Activity

(You may check the MATHCO Career Wall Charts to get more information about a career in which you are interested.)

OCCUPATIONS	SUBJECTS NEEDED IN HIGH SCHOOL
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Are you interested in any of these careers? Remember, you can be anything you want to be--if you are qualified.

Women and men can do the same jobs with equal success. Can't both women and men enter each of the occupations you've listed above?

Exploring on Your Own

1. Make drawings based on other geometric motifs (circles, triangles, etc.).
2. Visit a local theatre to see how flats are made and used.

MODULE 2, NUMBER 12 - GRAPHS AND FRACTIONS/ART AND DRAMA

Worksheet

Continue these patterns:

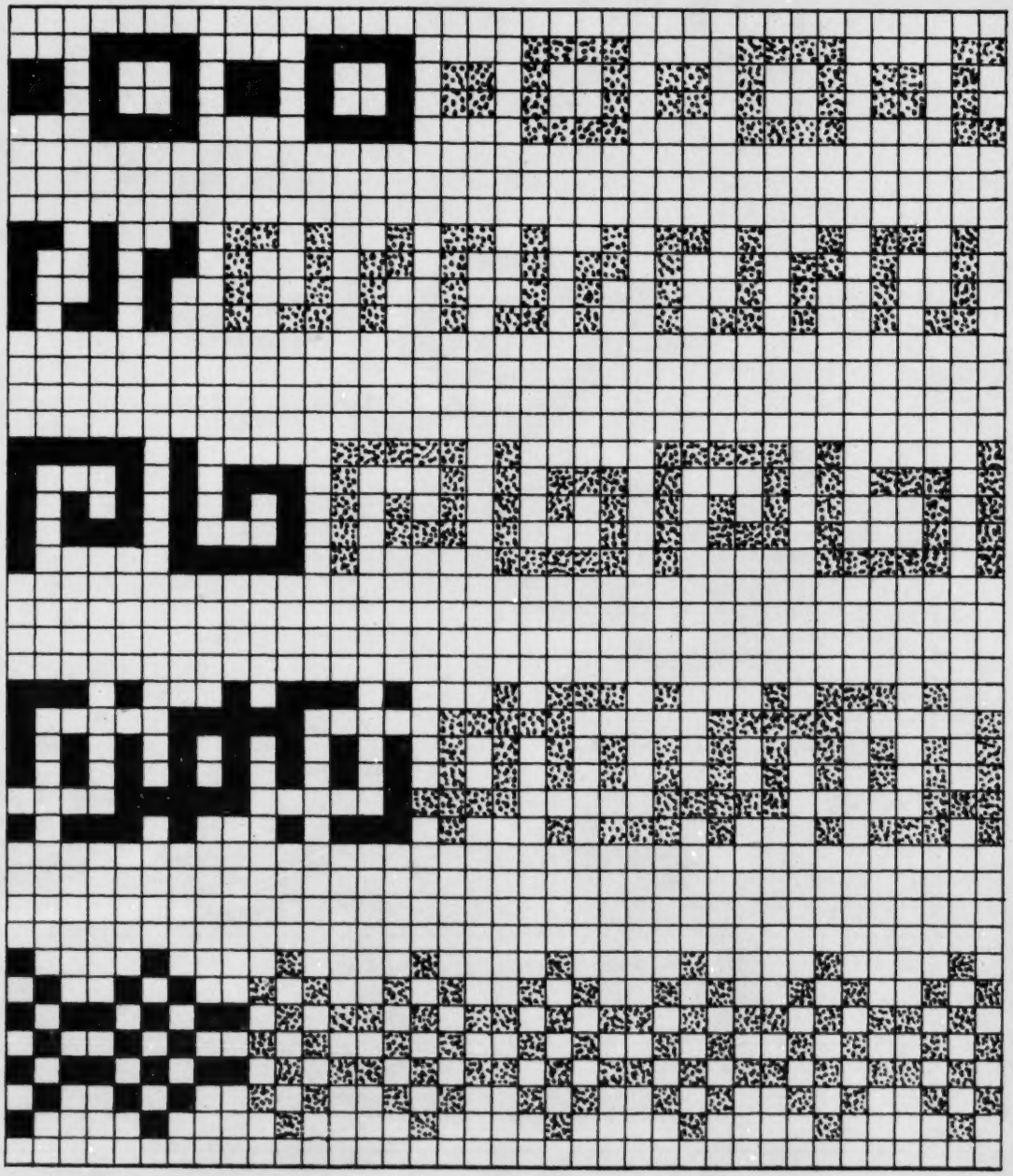
1.

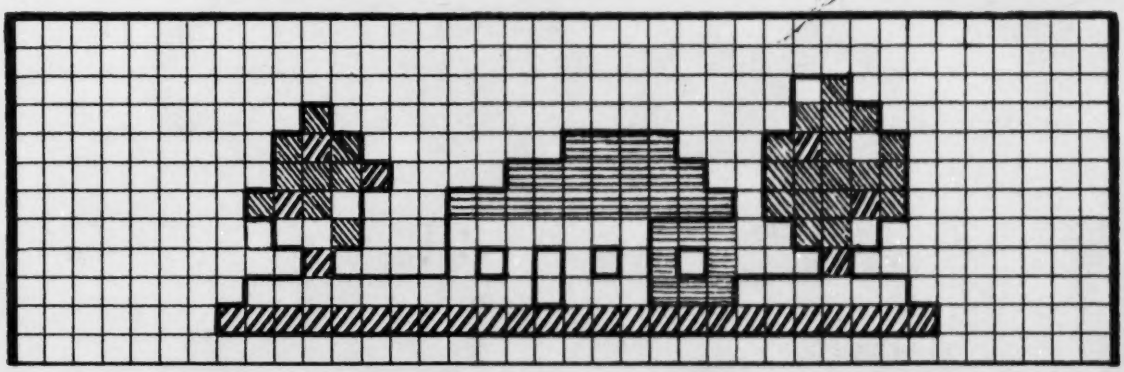
2.

3.

4.

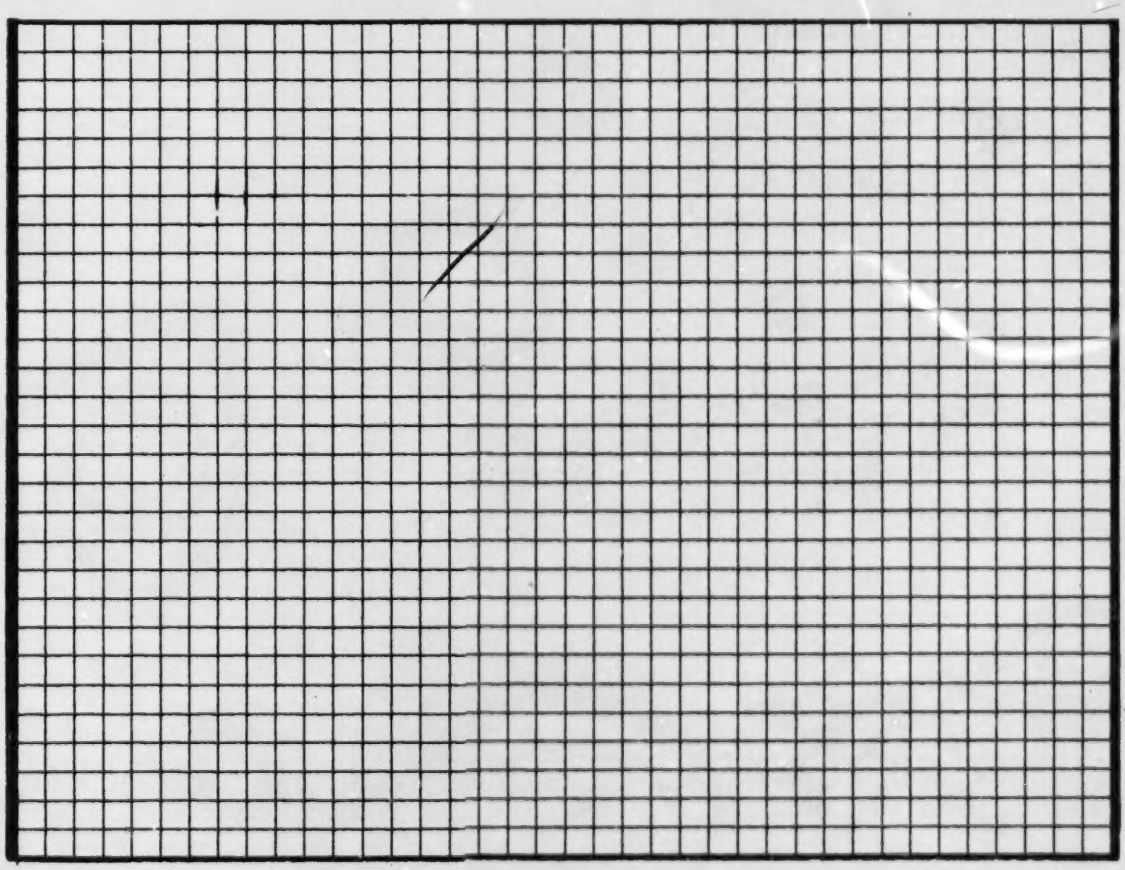
5.





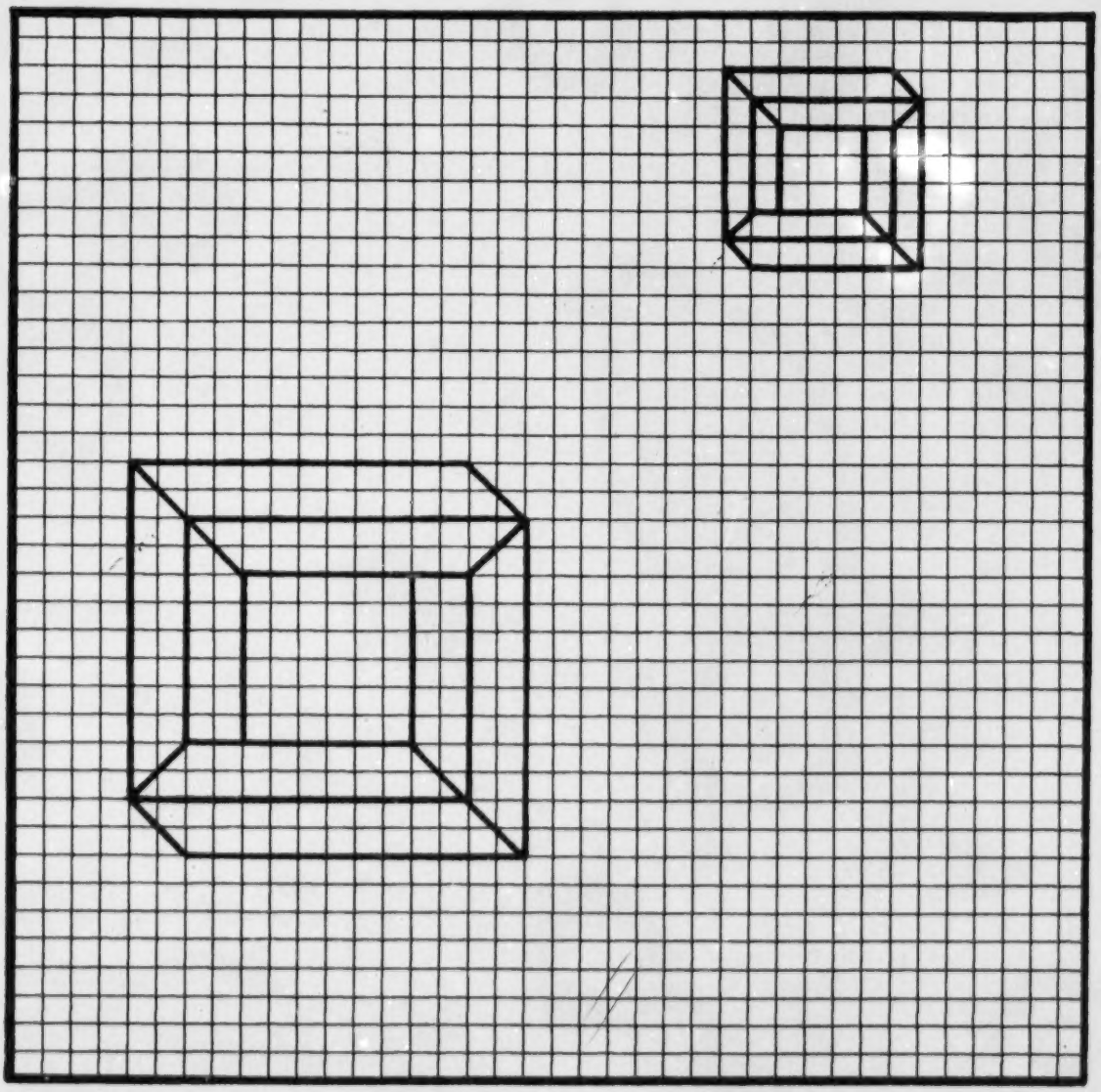
Using at least three color values, shade whole squares to make a picture above.

Use the space below to create your own picture, using at least three color values.



Enlarge the drawing below by using two squares in your drawing for every one square in the original.

(2:1 ratio)

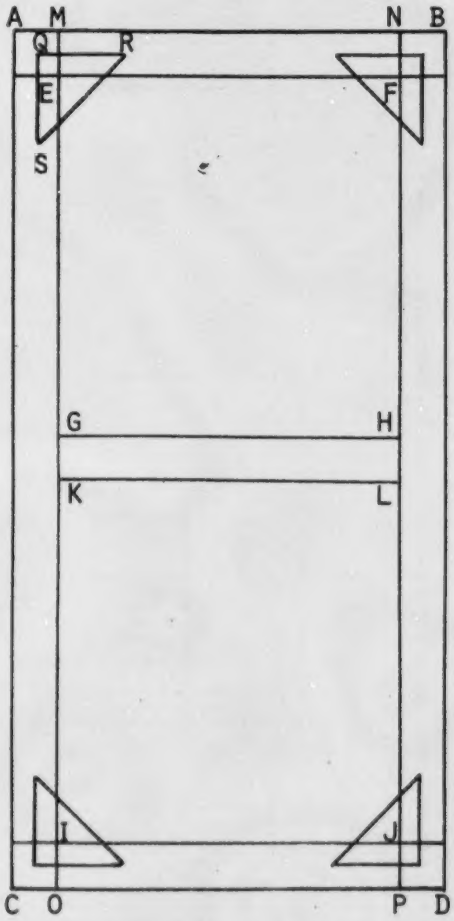


Flats are made by people preparing scenery for a play or a musical drama. They are made from wood and muslin (or canvas) and are usually very large in size. Careful measurement is necessary to make sure that each flat is both attractive and sturdy. After they are assembled, flats are painted to represent background scenery.

On a blank piece of paper, you are to make a scale drawing of the flat that is represented below. Each of the measurements on your scale drawing should be twice as long as the lengths shown on the original drawing.

Using your ruler and the given length measurement (AB = 2½"), first figure out all of the other lengths on the original scale drawing and write them on the chart below under GIVEN. Then multiply each of these lengths by 2 to find your new (and larger) measurements. Enter these new figures below under SCALE.

You are now ready to make your scale drawing.



GIVEN:	SCALE:
AB = 2½"	AB = 5"
AC = 5"	AC = 10"
MN = 2"	MN = 4"
GK = ¼"	GK = ½"
EG = 2-1/8"	EG = 4¼"
QR = ½"	QR = 1"
RS = 3/4"	RS = 1½"
QS = ½"	QS = 1"
AM = ¼"	AM = ½"

MODULE 2, NUMBER 13 - GRAPHS, CHARTS, FRACTIONS/DRAMA

Teacher Activity Sheet

Overview

Your students will use their reasoning powers and math skills to help them work through problems dealing with ticket sales, comparisons, and theatre house management.

Math Skills Your Students Will Need

Addition, subtraction, multiplication, and division of fractions. Interpretation of word problems, ordering of operations, and reading charts and graphs.

Time Allotment

Two class periods.

Objectives

Your students will:

1. Use information from a diagram and chart to help them solve problems.
2. Reinforce their skills in working with fractions.
3. Discover a few of the rudiments of box office and theatre house management.
4. Explore some applications of mathematical procedures to practical situations.

Materials Your Class Will Need

Graphs, Charts, Fractions/Drama Worksheets and pencils.

Vocabulary

house:	the seating area of a theatre or auditorium; the place for the audience
orchestra seats:	seats on the same floor or level as the orchestra or stage
balcony seats:	upper-level seats usually over the back part of the orchestra seats
sellout/sold out:	when all the tickets for the house, or seats in a particular section, are sold
grip:	a stagehand who helps with equipment

Self-Concept Builder

Your students will use skills they already have to explore a part of the world of the theatre.

Activity

1. Using the information given in the charts, students will answer the questions on the Worksheets.
2. Discuss with your students the connections between this activity and mathematics.

Occupations Related to This Activity

What occupations might use an activity similar to this one? Have your students complete the career section on their Activity Sheets. After class discussion, they should add these occupations to the list:

BOX OFFICE MANAGER	CONCERT COORDINATOR	PRODUCER
HOUSE MANAGER	ROAD MANAGER	AGENT
TICKET AGENT	THEATRICAL BROKER	

Discuss the kinds of courses people going into these occupations should take in high school. Have your students add these courses to their Activity Sheets.

Stress that women and men can be equally successful in most careers, if they are qualified.

Suggested Independent Activities

(These suggestions appear on Student Activity Sheets.)

1. Visit a theatre or concert hall in your community to find out how its box office and house are managed.
2. Organize the ticket sales for an event at school.

MODULE 2, NUMBER 13 - GRAPHS, CHARTS, FRACTIONS/DRAMA

Student Activity Sheet

Your Name _____ Date _____

Overview

In this activity, you will use your math skills to explore the world of box office and theatre house management.

Math Skills You Need to Remember

Working with fractions, reading charts and graphs, and interpreting word problems.

Things You Will Need

Graphs, Charts, Fractions/Drama Worksheet and a pencil.

Vocabulary

house:	the seating area of a theatre or auditorium, the place for the audience
orchestra seats:	seats on the same floor or level as the orchestra or stage
balcony seats:	upper-level seats usually over the back part of the orchestra seats
sellout/sold out:	when all the tickets for the house, or seats in a particular section, are sold
grip:	a stagehand who helps with equipment

When You Finish You Will Be Able To

1. Know something about the work that is required to manage a theatre or an auditorium.
2. Be able to apply your math skills to problems in house management.

Activity

Use the information on the charts to help you figure out the problems on the Worksheet.

Occupations Related to This Activity

(You may check the MATHCO Career Wall Charts to get more information about a career in which you are interested.)

OCCUPATIONS	SUBJECTS NEEDED IN HIGH SCHOOL
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Are you interested in any of these careers? Remember, you can be anything you want to be--if you are qualified.

Women and men can do the same jobs with equal success. Can't both women and men enter each of the occupations you've listed above?

Exploring on Your Own

1. Visit a theatre or concert hall in your community to find out how its box office and house are managed.
2. Organize the ticket sales for an event at school.

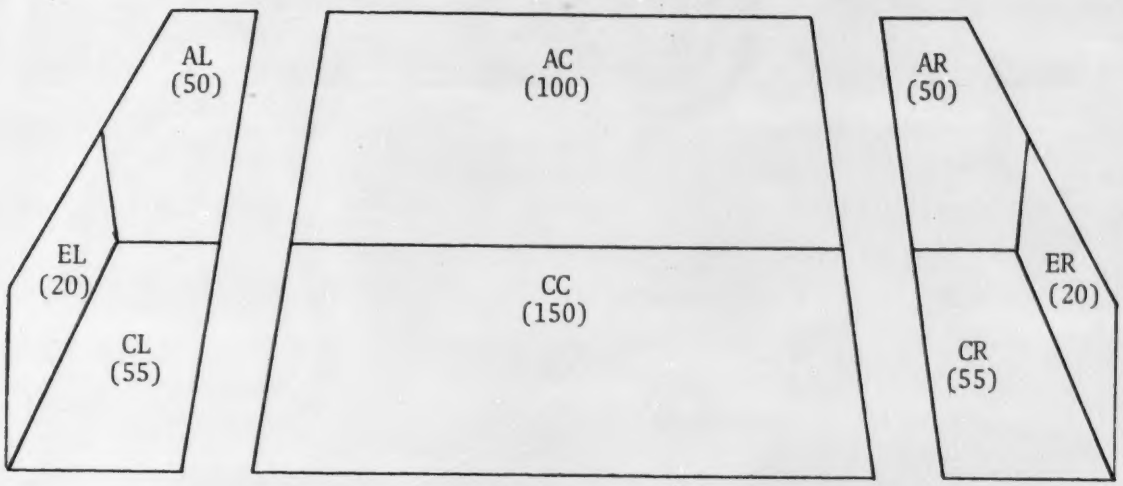
MODULE 2, NUMBER 13 - GRAPHS, CHARTS, FRACTIONS/DRAMA

Worksheet

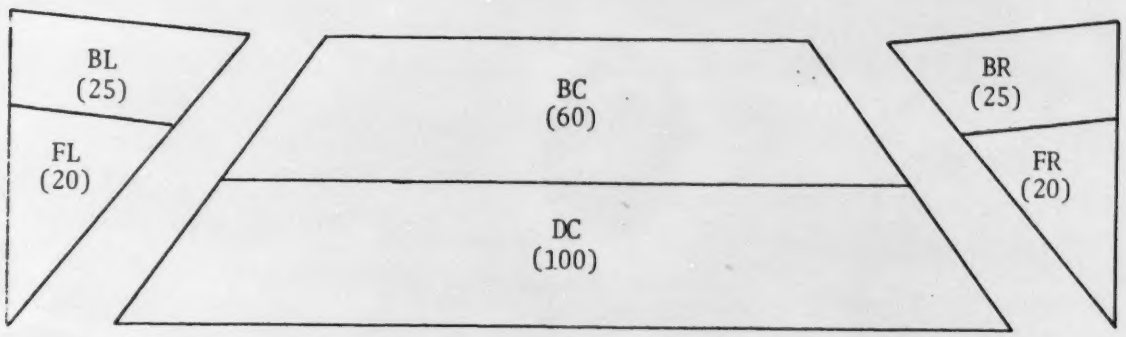
You will be using the information given on the first two pages of this Worksheet to help you solve the problems found on pages three and four.

CHART 1

--STAGE--



ORCHESTRA SEATS



BALCONY SEATS

CHART 2

ORCHESTRA SEATS

Section A, center:	100 seats
Section A, left:	50 seats
Section A, right:	50 seats
Section C, center:	150 seats
Section C, left:	55 seats
Section C, right:	55 seats
Section E, left:	20 seats
Section E, right:	20 seats

BALCONY SEATS

Section B, center:	60 seats
Section B, left:	25 seats
Section B, right:	25 seats
Section D, center:	100 seats
Section F, left:	20 seats
Section F, right:	20 seats

CHART 3

CONCERT TICKET PRICES

Section A:	$20.00
Section B:	$15.00
Section C:	$10.00
Section D:	$10.00
Section E:	$ 5.00
Section F:	$ 5.00

LECTURE TICKET PRICES

General Admission: (All left and right sections)	$3.00
Reserved Seats: (All center sections)	$6.00

1. Balcony seats make up what fraction of the house? *1/3*

2. Orchestra seats make up what fraction of the house? *2/3*

3. Center section seats make up what fraction of the house? *410/750 or 41/75*

4. "A" section seats make up what fraction of the house? *200/750 or 4/15*

5. "D" section seats make up what fraction of the house? *100/750 or 2/15*

6. How much money is taken in with a full house at a concert? *$9,650*

7. How much money is taken in with a full house at a lecture? *$3,480*

8. What fraction of the total taken in at a lecture comes from general admission seats if the house is full? *510/3,480 or 17/116*

9. How much money comes from selling out the balcony at a concert? *$2,850*

10. What fraction of the total monies taken in at a sold-out concert comes from "C" seats? *1,300/9,650 or 26/193*

11. How much money is lost by closing the balcony during a lecture? *$1,230*

12. At a recent concert, "A" section was three-fourths full, "B" section was sold out, "C" and "D" sections were both half full, and sections "E" and "F" were both empty. How many people attended the concert? *440 people*

13. How much money was taken in the night of the concert described in Problem 12? *$6,450*

14. At a recent concert, the balcony was closed, but the orchestra seats were all full. At the lecture the next night, the house sold out. Which event took in the most money?

The concert

15. At a symphony concert, sections "A" and "C" were sold out, section 'E' was filled except for 13 seats in the back, and the balcony was closed. At a band concert, the balcony was sold out, but the orchestra seats were only half full in each section. Which concert took in the most money?

The symphony concert

16. As a publicity gimmick for a new rock group, concert tickets were sold at half price. With this reduced rate, the house quickly sold out. From the money taken in at the concert, the rock group paid their agent 10 percent, paid $2,000 to rent the auditorium, paid $150 to print the tickets, paid $600 for security guards, paid $450 to their grips, and was charged $600 for damage done to the seats by their fans. The five members of the group split up what was left. How much money did each musician get?

$108.60

MODULE 2, NUMBER 14 - MAKING A MUSIC COMPUTER

Teacher Activity Sheet

Overview

Your students will make a simple computer that, when used correctly, will give them answers to a wide variety of questions that relate to the mechanics and mathematics of music. This activity and the one that follows it are rather difficult, and may be used as optional activities.

Math Skills Your Students Will Need

Manipulation of materials, ordering of operations, and following directions.

Time Allotment

One to two class periods (and possibly homework).

Objectives

Your students will:

1. Make a computer to help find the answers to problems.
2. Manipulate the materials of scissors, paper, and paste.
3. Be introduced to a music vocabulary.
4. Gain experience in following directions.
5. Gain experience in ordering operations.

Materials Your Class Will Need

Computer patterns, 200-lb. oak tag or poster board, scissors for each student, paste, paper brads (one per student), felt-tip pens, colored pencils, crayons.

Vocabulary

computer:	a tool or machine that can provide the answers to specific questions
concentric circles:	circles that have the same midpoint

Self-Concept Builder

Your students will get to use a "craft activity" to build a tool that will provide them with answers to difficult questions.

Activities

1. Each student should have the four computer patterns, at least two 12" x 18" pieces of 200-lb. oak tag, scissors, a brad, and paste.
2. Cut out the four circles, leaving a ½-inch excess all around.
3. Paste circles to oak tag (paste entire surface smoothly).
4. Trim circles and oak tag carefully around the edges.
5. Cut the shaded area from the circle that has no words on it.
6. Carefully punch a small hole in the center of each circle.
7. Assemble the computer by stacking the circles from largest to smallest, concentrically.
8. From excess oak tag, cut a "washer" to put on the back.
9. Put brad through the centers and fasten in the back so that each circle rotates freely.
10. Discuss with your students the connections between this activity and mathematics.

Occupations Related to These Activities

What occupations might use activities similar to these? Have your students complete the career section on their Activity Sheets. After class discussion, they should add these occupations to the list:

MUSICIAN
COMPOSER
ARRANGER
MUSIC THEORIST
MUSIC TEACHER

Discuss the kinds of courses people going into these occupations should take in high school. Have your students add these courses to their Activity Sheets.

Stress that men and women can be equally successful in most careers, if they are qualified.

Suggested Independent Activities

(These suggestions appear on Student Activity Sheets.)

1. Decorate your computer using color pencils, felt-tip pens, crayons, or whatever you wish. Just be sure that your decoration does not interfere with the functioning of the computer.
2. To make your computer last longer, you may wish to laminate each part of it, or cover each part of it with clear contact paper.

MODULE 2, NUMBER 14 - MAKING A MUSIC COMPUTER

Student Activity Sheet

Your Name _____ Date _____

Overview

This activity will enable you to build a computer that, when properly operated, will give you the answers to some very tough questions about music.

Math Skills You Need to Remember

Following directions and ordering operations.

Things You Will Need

Computer patterns, oak tag or poster board, scissors, paste, a brad, felt-tip pens, crayons, or colored pencils.

Vocabulary

computer:	a tool or machine that can provide the answers to specific questions
concentric circles:	circles that have the same midpoint

When You Finish You Will Be Able To

Use your computer to answer questions related to the mathematics of music.

Activity

Following the directions given by your teacher, make a music computer as accurately and as neatly as you can.

Occupations Related to This Activity

(You may check the MATHCO Career Wall Charts to get more information about a career in which you are interested.)

OCCUPATIONS	SUBJECTS NEEDED IN HIGH SCHOOL

Are you interested in any of these careers? Remember, you can be anything you want to be--if you are qualified.

Women and men can do the same jobs with equal success. Can't both women and men enter each of the occupations you've listed above?

Exploring on Your Own

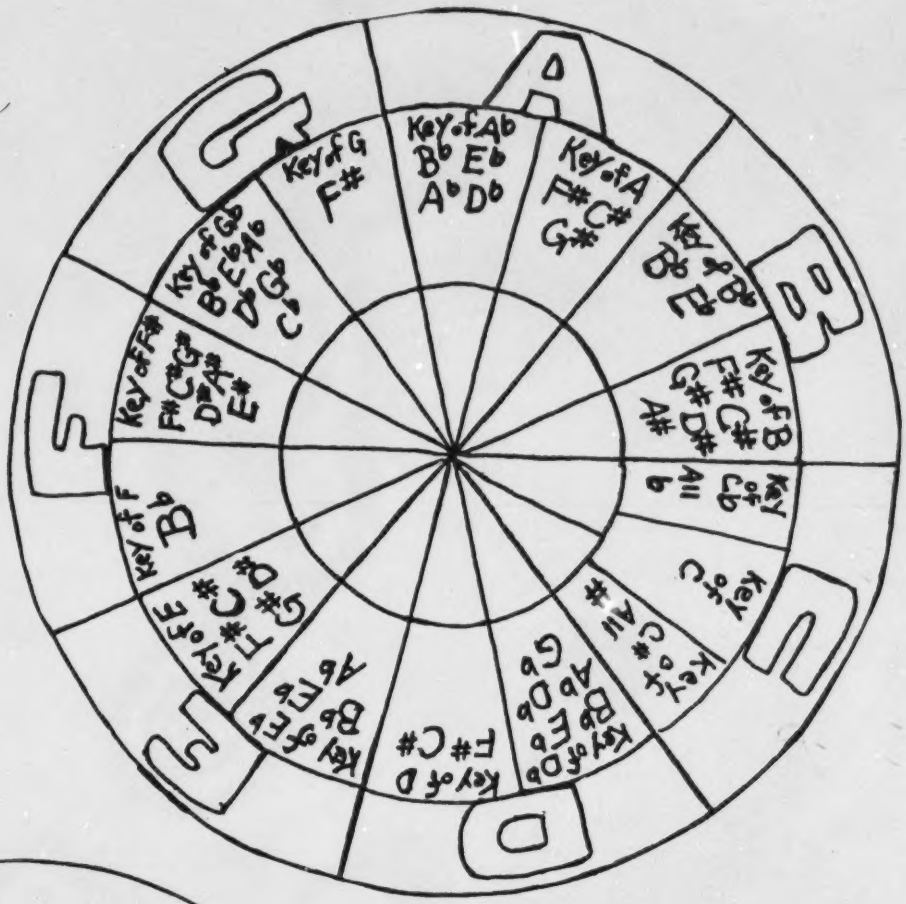
1. Decorate your computer using colored pencils, felt-tip pens, crayons, or whatever you wish. Just be sure that your decoration does not interfere with the functioning of the computer.
2. To make your computer last longer, you may wish to laminate each part of it, or cover each part of it with clear contact paper.

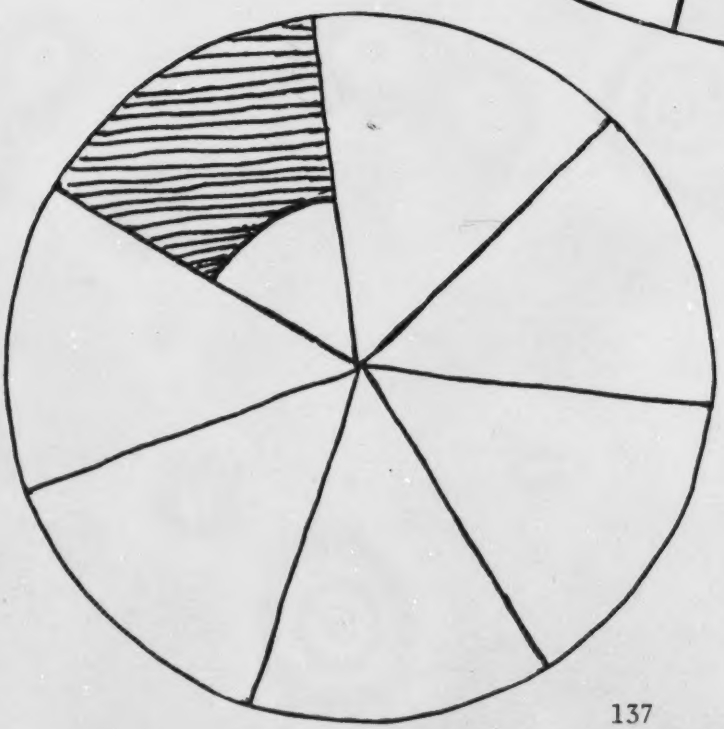
MODULE 2, NUMBER 14 - MAKING A MUSIC COMPUTER

Worksheet

PATTERN PIECES

PATTERN PIECES





MODULE 2, NUMBER 15 - USING A MUSIC COMPUTER

Teacher Activity Sheet

Overview

Your students will discover how to use the computer to find the answers to complicated questions about music theory by using math operations and music terminology.

Math Skills Your Students Will Need

Substitution, evaluation, and ordering of operations.

Time Allotment

One to four class periods.

Objectives

Your students will:

1. Be introduced to the vocabulary of music theory.
2. Explore the concept of movable "do."
3. Explore the concept of chord building and spelling.
4. Explore the concept of keys and key relationships.
5. Gain experience in the ordering of operations.
6. Gain experience in the substitution of variables.
7. Gain experience in encoding and decoding information.
8. Gain experience in reading Roman numerals.
9. Gain experience in using tools to help find the answers to questions and problems.

Materials Your Class Will Need

Music computers built in previous activity and Using a Music Computer Information Sheets and Worksheets.

Vocabulary (Musical Terms):*

scale:	the seven tones that form the basis of our system of music
tone names:	tonic, supertonic, mediant, subdominant, dominant, submediant, leading tone
tone syllables:	do, re, mi, fa, sol, la, ti
tone numbers:	capital Roman numerals = major lowercase Roman numerals = minor
chord:	more than one tone sounded (played or sung) at the same time
triad:	a three-tone chord
root:	the tone upon which a chord is built
sharp:	a tone alteration that raises the pitch, represented by #
flat:	a tone alteration that lowers the pitch, represented by ♭
key:	the tonal quality of a scale

Self-Concept Builder

Your students will discover that they can make and use a tool to help them solve complicated problems using musical terminology.

Activity

1. As you explain the operation of the music computer, your students are to use it to answer questions of increasing complexity.
2. After this activity is finished, let students discuss their answers with other students, or in small groups.
3. Discuss with your students the connections between this activity and mathematics.

*Many of these terms have other meanings when removed from the context of music. This may be an excellent discussion topic for your class.

Occupations Related to This Activity

What occupations might use an activity similar to this one? Have your students complete the career section on their Activity Sheets. After class discussion, they should add these occupations to the list:

MUSICIAN	MUSIC THEORIST
COMPOSER	MUSIC THERAPIST
ARRANGER	MUSIC TEACHER

Discuss the kinds of courses people going into these occupations should take in high school. Have your students add these courses to their Activity Sheets.

Stress that men and women can be equally successful in most careers, if they are qualified.

Suggested Independent Activities

(These suggestions appear on Student Activity Sheets.)

1. Discuss your music computer with a professional musician or music student.
2. Research the "mathematics" of music.
3. Organize a computer contest to see who can use his or her computer with the most accuracy.

MODULE 2, NUMBER 15 - USING A MUSIC COMPUTER

Student Activity Sheet

Your Name _____ Date _____

Overview

This activity will help you discover how to use a computer to solve complicated problems using the mechanics and vocabulary of music.

Math Skills You Need to Remember

Substitution of variables, evaluation of expressions, and ordering of operations.

Things You Will Need

Your music computer and the Using a Music Computer Information Sheet and Worksheet.

Vocabulary*

scale:	the seven tones that form the basis of our system of music
tone names:	tonic, supertonic, mediant, subdominant, dominant, submediant, leading tone
tone syllables:	do, re, mi, fa, sol, la, ti
tone numbers:	capital Roman numerals = major lowercase Roman numerals = minor
chord:	more than one tone sounded (played or sung) at the same time
triad:	a three-tone chord
root:	the tone upon which a chord is built
sharp:	a tone alteration that raises the pitch, represented by #
flat:	a tone alteration that lowers the pitch, represented by ♭
key:	the tonal quality of a scale

*Many of these terms have other meanings when removed from the context of music. Do you know any of these other meanings?

When You Finish You Will Be Able To

Use your computer to answer questions about music.

Activity

As your teacher helps you discover how to use your computer, you will use it to answer questions about music.

Occupations Related to This Activity

(You may check the MATHCO Career Wall Charts to get more information about a career in which you are interested.)

OCCUPATIONS	SUBJECTS NEEDED IN HIGH SCHOOL
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Are you interested in any of these careers? Remember, you can be anything you want to be--if you are qualified.

Women and men can do the same jobs with equal success. Can't both women and men enter each of the occupations you've listed above?

Exploring on Your Own

1. Discuss your music computer with a professional musician or music student.
2. Research the "mathematics" of music.
3. Organize a computer contest to see who can use her or his computer with the most accuracy.

MODULE 2, NUMBER 15 - USING A MUSIC COMPUTER

Information Sheet

THE LETTER CIRCLE

The letter circle is divided into seven sections. Each section contains a letter of the alphabet--A through G. The letter circle rotates above the outer circle. Whichever letter is positioned under tonic becomes the name of the key. For example, the letter C under tonic represents the key of C. Each letter then becomes synonymous with the elements it is under. For example, with C under tonic, E becomes the mediant, mi, and iii. By changing the letter under tonic, you can determine the letter name of any scale position in any key. Here are some sample questions that you can answer by using the outer and letter circles:

In the key of A, what letter is V?	(E)
If D is la, what key are you in?	(F)
What number is E in the key of D?	(ii)
If A is do, what letter is sol?	(E)
What key has E as its leading tone?	(F)

THE OUTER CIRCLE

The outer circle is divided into seven sections. Each section contains three elements (with the exception of the tonic, which has four). These elements are:

TONE NAMES	TONE SYLLABLES	TONE NUMBERS*
tonic	do	I
supertonic	re	ii
mediant	mi	iii
subdominant	fa	IV
dominant	sol	V
submediant	la	vi
leading tone	ti	vii

*Capital Roman numerals indicate major keys and lowercase Roman numerals indicate minor keys.

The three elements within each segment may be used interchangeably. For example, submediant = la = vi. Some sample questions using the outer circle are:

What syllable is the dominant?	(sol)
Is the mediant major or minor?	(minor)
What number is the leading tone?	(vii)
What is the tone name for re?	(supertonic)
What tones are major?	(tonic, subdominant, and dominant)
What are the syllables for I, iii, and V?	(do, mi, and sol)

THE WINDOW

The window in the third circle fits the space under the letters. The window should always be opened under tonic. Through the open window, you can see two keys that begin with the letter under tonic--one using sharps and one using flats (except for C, which has three versions--sharps, flats, and no sharps or flats). When using the window, be sure to indicate which of the two keys you are referring to: F or F#, for example. Under the names of the keys in the window are listed the letters that are altered in those keys. For example, in the key of F, B becomes B♭. Always check the window to see if the letter you are using is altered. Some sample questions that can be answered using the outer circle, the letter circle, and the window are:

Which key uses four sharps?	(E)
In the key of A, what is the leading tone?	(G#)
What letters are altered in the key of B?	(F, C, G, D, A)
In the key of B♭, what is fa?	(E♭)
What letter is supertonic in the key of F#?	(G#)

THE INNER CIRCLE

The inner circle is the chord builder. With the other circles stationary, the chord builder can be rotated to put the root under any scale tone. Triads are spelled by giving the letters (plus key alterations) of the root, the third, and the fifth. The triad is determined to be major or minor by checking the Roman numeral above the root. The elements above the root name the triad. For example, in the key of A, the dominant triad is spelled E, G#, and B. You can tell that it is major, because the Roman numeral for dominant is V. Some sample questions that can be answered using the entire computer are:

What letter is the third of the subdominant triad in the key of B?	(G#)
Spell the leading tone triad in the key of E.	(D#, F#, A)
Spell the V triad in the key that has $B^{\flat}$ as its mediant.	($D^{\flat}$, F, A)
Is C, $E^{\flat}$, and G a major or a minor triad in the key of A?	(Minor)

MODULE 2, NUMBER 15 - USING A MUSIC COMPUTER

Worksheet

DIRECTIONS

Using your music computer to determine the correct answers, write your responses neatly in the blank by each question. After you complete this activity, discuss your answers with one of your classmates. Did you both get the same answers?

F 1. If A is a do, what is la?

E 2. If B is fa, what is ti?

D 3. If G is sol, what is re?

C 4. If E is mi, what is do?

E 5. Which key uses four sharps?

F 6. Which key uses one flat?

B 7. Which key uses five sharps?

F#, C#, G# 8. Which notes are sharped in the key of A?

E 9. If B is the leading tone, what is the mediant?

B 10. If F# is the dominant, what is tonic?

E 11. If G is the subdominant, what is the supertonic?

B 12. Which key has A as its leading tone?

D 13. Which key has G as its subdominant?

E 14. Which key has G# as its mediant?

G, B, D 15. Spell the tonic triad in the key of G.

Minor 16. Is the supertonic triad in the key of B major or minor?

C, E♭, G 17. Spell the mediant triad in the key of A♭.

B 18. What is the third of the subdominant triad in the key of D?

F 19. What is the fifth of the subdominant triad if D is 1a?

B♭, D♭, F♭ 20. Spell the leading tone triad in the key of C♭.

E 21. What would be the third of the dominant triad if D is 1a?

B♭ 22. In the key of F, what letter is IV?

Yes 23. In the key of E, is iii sharped (answer yes or no)?

C# 24. In the key of A, what is the root of the chord that has E as its third?

Major 25. In the key of C, is the triad that has B as its third major or minor?

True 26. In keys that use sharps, the leading tone is always sharped (answer true or false).

D, F#, A 27. Spell the subdominant triad in the key that has G# as vii.

More than one 28. How many notes are used in a chord?

7 29. How many letters are in the musical alphabet?

C major 30. Which key has no sharps or flats?